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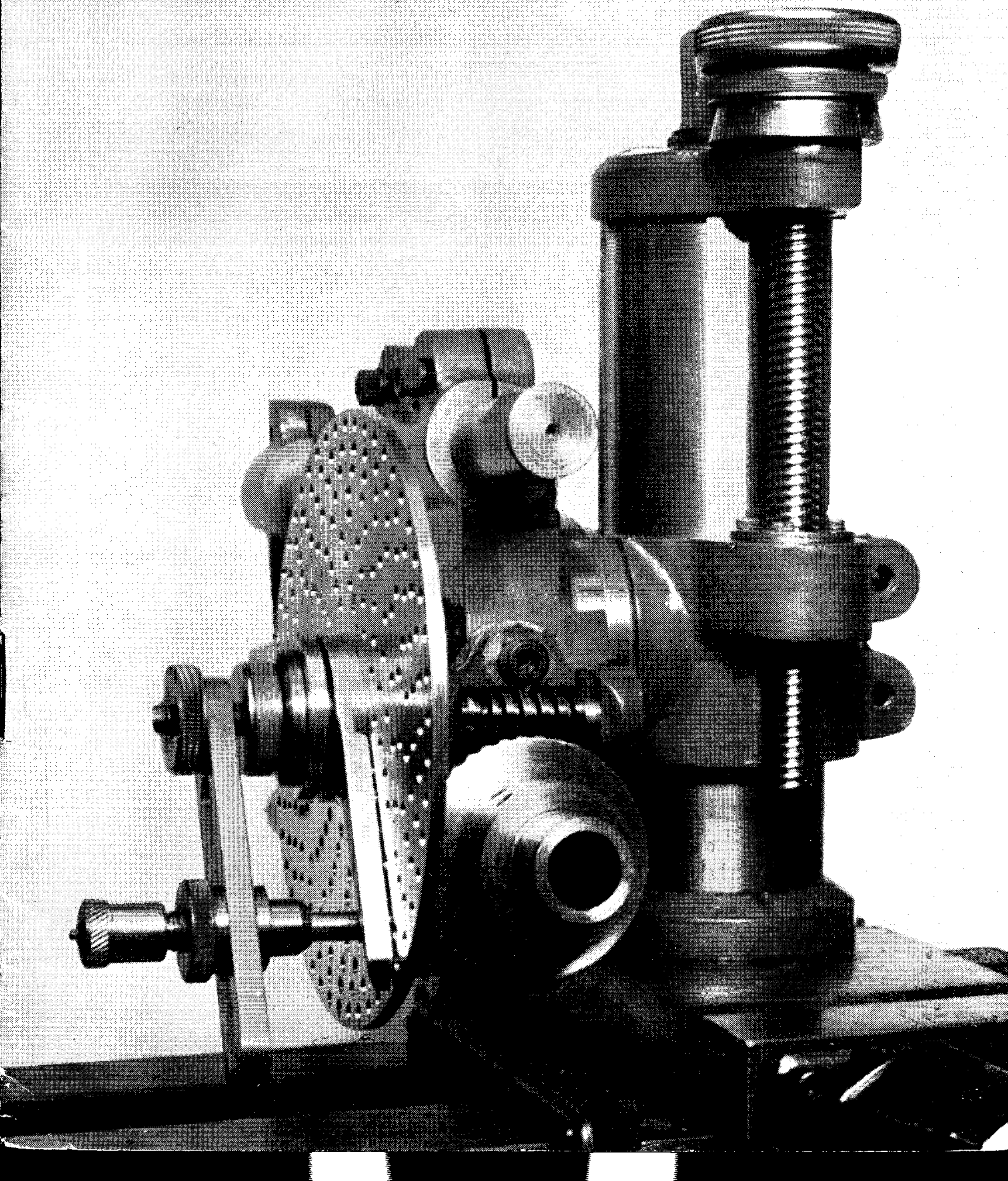
THE MODEL ENGINEER



The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

13TH DECEMBER 1951

VOL. 105 NO. 2638

SMOKE RINGS

Our Cover Picture

● THIS PHOTOGRAPH illustrates the dividing head at present being described in these pages. The actual head was on show at this year's "M.E." Exhibition.

In reply to a number of enquirers, the castings for the Potts vertical slide are not suitable because the one illustrated is considerably larger.

Since the article was written, things have become more difficult and it is suggested that in place of "Meehanite" for the machine vice, malleable castings, or fabricated mild-steel be used.

The dull white finish on the show model was unpolished silver plate—this was used just to be different.

The "M.E." Allchin Traction Engine

● IN HIS book *Traction Engines Worth Modelling*, Mr. W. J. Hughes mentions the fact that he had begun the construction of a 1½-in. scale model of an Allchin engine. The drawings, full size for the model, are being made as the model's construction progresses, but the general arrangement and details drawing of the tender, and three sheets of details are already on our blueprint list under the number T.E.11.

In next week's issue, Mr. Hughes will begin a description of the construction, and we are sure that this will be of the greatest interest and use to builders of traction engines of most types, not only to those who favour the Allchin. The article will keep in step, as it were with Mr. Hughes's work on his model. A major misfortune has caused considerable delay in the publication of the article; the tender which Mr. Hughes had completed was lost after an exhibition and has never been found, and this has meant that Mr. Hughes has had to begin all over again! However, we hope that such an accident will not be met with again, and that the construction of the model and the writing about it will proceed smoothly and undisturbed.

Christmas Holiday Arrangements

● DUE TO the fact that Christmas Day falls on a Tuesday this year, there will be a slight dislocation of our publishing routine. Will all readers please note that the issue of the "M.E." dated December 27th, 1951, will be delayed by 24 hours, and copies will not be on sale until Friday, December 28th?

"Facts About Welding"

● IN OUR November 1st issue, we published an article on the application of welding processes to the repair of models, contributed by Mr. C. W. Brett, M.Inst.W., who is managing director of Barimar Ltd., the acknowledged authorities on repair of machinery by welding processes. The information in this article, embodying the results of many years' experience in this highly specialised work, has been appreciated by many readers, and the question has been broached regarding the possibility of publishing further articles on modern engineering processes by acknowledged authorities in the respective subjects. We should welcome the views of other readers on this matter.

We may mention that Messrs. Barimar are always willing to advise on the possibility of repairing damaged machinery and components of any type and size.

"Highland Chieftain" Found

● IN OUR issue for November 1st, we reported the theft of the fine 2½-in. gauge L.M.S. locomotive *Highland Chieftain* from the window of the Engineering Centre, Glasgow; we are delighted to be able to announce that the engine has been recovered and returned to its owner, Mr. W. M. Hunter. This good news is conveyed to us in a letter from Mr. Allan Rodger, the genial secretary of the Glasgow Society of Model Engineers, and we reprint the story in the vernacular in which he wrote it :—

"A Glasgow chap who is a moulder to trade went into a pub, his pint to have on the Saturday evening after the loss of *Highland Chieftain* had been kindly reported in THE MODEL ENGINEER. During the period he was in the hostelry, he was in conversation with a total stranger who enquired where the moulder was employed. In the course of their chat, our friend of the sand, loam, cores and melted metal mentioned his interest in small working locos and how he would like to possess one but had not the facilities to build one. 'You're just the bloke I'm looking for. I ken a chap wha has yin for sale,' says the stranger. 'If you are interested I'll take you to a china of mine wha's sellin' his.' 'But what kind is it? Is it coal-fired? What size is it? I'm efter yin that can pu' me on a track. Nae wee shilpit thing for me,' said the moulder. 'Man, it's the whole cheese. It has fower wee wheels and six big yins. It's a twa-and-a-hauf gauger, but it hasnae got a tender. This yin will pu' you, the wife and your weans. You just come alang wi' me and hae a dekko, the bloke that has it disnae ken hoo tae make it go right.'

"'Smells like the *Chieftain*,' thinks our friend and follows up the clue to such purpose that our *Chieftain* has now returned to his clansmen. The Glasgow Society of Model Engineers would take this opportunity of thanking THE MODEL ENGINEER for the publicity given advising of our loss and which, it would seem, was the means of bringing off a chance in a million. To our friend the moulder we say in all sincerity 'Thank you, Sir.' We also wish to thank Glasgow Police who so willingly helped in the recovery.

"We, of course, are very happy about this improvement in our fortunes as is also our good friend Wm. M. Hunter, of Kilmarnock, the owner, whose demeanour during the period his loco was missing proved without doubt to be a very good friend of our society."

New Electric System for B.R.

● BRITISH RAILWAYS have decided to carry out a trial of the single phase 50-cycle a.c. system of electric traction. The trial will be carried out on the Lancaster-Morecambe-Heysham Line, which was originally electrified experimentally in 1908 at 6,600 volts, 25 cycles, the quipment of which is now life expired. By arrangement with the principal electrical manufacturers, various methods and types of equipment are to be tried out, and the overhead line voltage will be varied from the present 6,600 volts up to and including 20,000 volts.

This traction system, says the Railway Executive, in which current is fed directly to the trains at high voltage and at the standard national frequency, was recommended by the recent B.T.C. Report on Electrification for consideration for secondary lines, the recommended system for lines carrying heavier traffics being 1,500 V, d.c. overhead. It introduces special problems, but also several advantages, including the use of a lighter overhead system, fewer and simpler substations and the absence of power cables alongside the track. As a result of recent advances in technical development it may now have a wider field of economic application.

This experimental electrification will provide experience of the suitability of standard frequency a.c. electrification for conditions in this country.

Calling West Cumberland

● MR. HARRISON BACON, 21, Main Road, Seaton, Workington, Cumberland, informs us that there is a proposal to form a society of model engineers to cover West Cumberland. He states that there is a population of about 80,000 within a radius of eight miles round Workington, and he knows of eight "Hielan' Lassies," five traction engines and several power boats in the area. If anyone is interested in the proposal, would he please communicate with Mr. Bacon, at the address given above, so that a meeting can be called to discuss the matter.

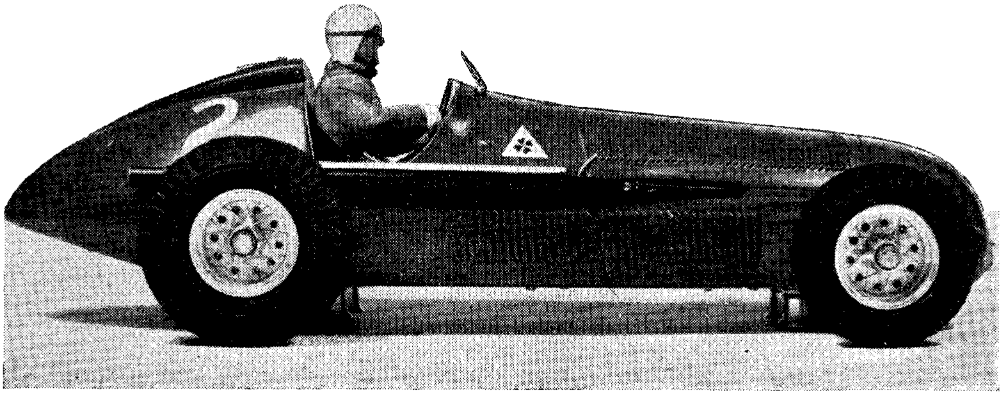
The "Marchant" Lubricator

● MR. J. DAVIES, 38, Stanley Road, Whalley Range, Manchester, 16, has built a 1¼-in. scale model of an early Aveling & Porter single-cylinder general-purpose traction engine, but requires details of the internal arrangement of the "Marchant" type of mechanical lubricator that was fitted to some of these engines. He possesses pictures showing the external appearance, and he has the instructions for fitting the lubricator, but no information as to the internal arrangement.

Aveling, Barford Ltd. regretted that they were not now able to supply any details; so, is it possible that some of our readers can help? Mr. Davies would be grateful to hear from any reader who can supply information.

A MODEL GRAND PRIX RACING CAR

Rex Hays describes the construction of a miniature Alfa Romeo, Type 158, to $\frac{1}{12}$th scale



I BELIEVE I said in an article, which I wrote for THE MODEL ENGINEER some little while ago, words to the effect that in my most humble opinion, model motor racing had sacrificed, on the altar of speed, any attempts to become a sport or hobby, or what you will, based on a realistic scene, but had, I felt, degenerated into a feast of high performance without any interest or attention being given to the general appearance of the vehicles or the atmosphere of the circuit.

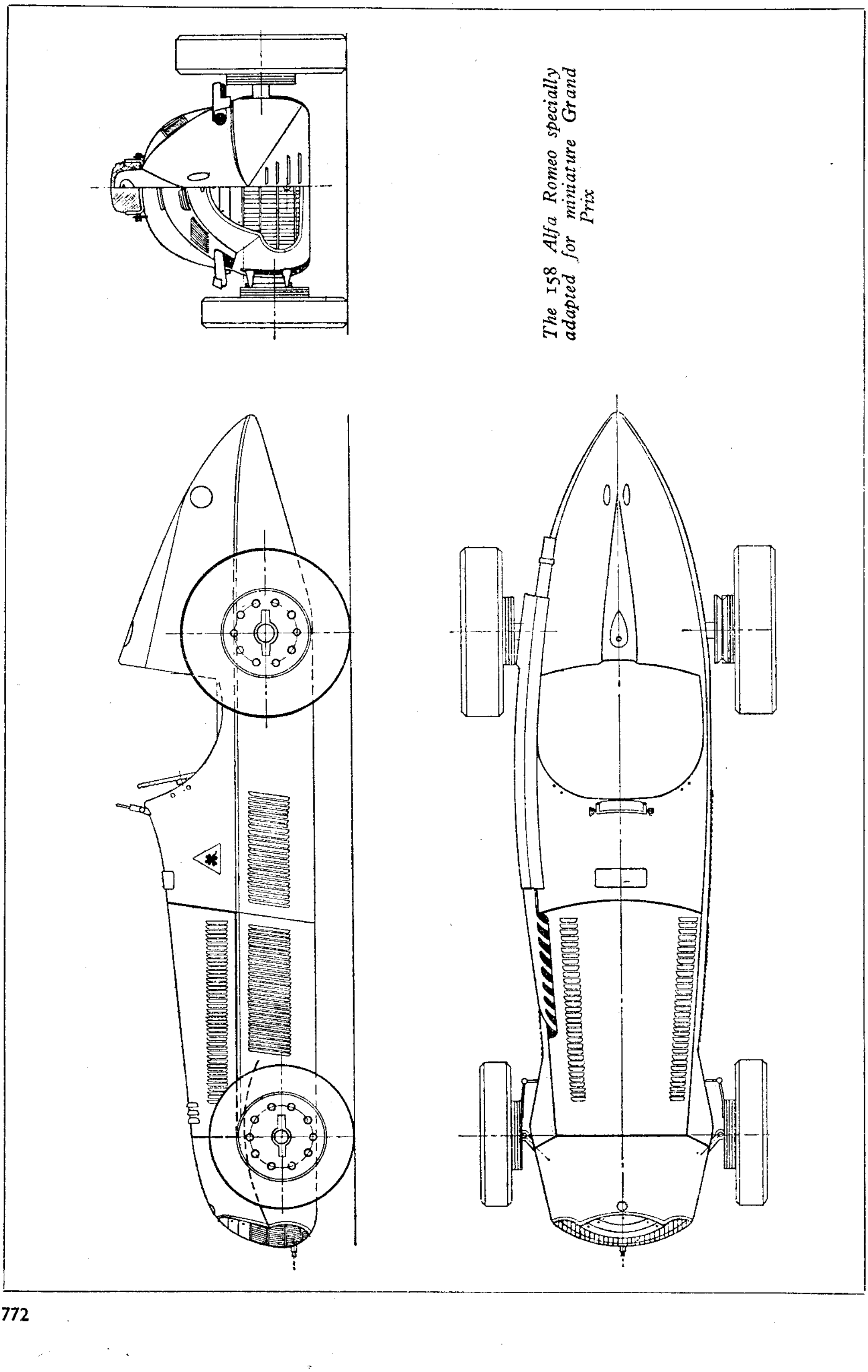
Now I am fully aware that there are those people who follow full scale motor racing with X-ray eyes. I have known many and have been amazed that they observe very little of the bodywork character and personality of the cars they are watching, but can only see the mechanical wonders whizzing up and down or round and round within the body shell. These people are very much in the minority, and I feel confident that most will agree when I say that the average enthusiast upon seeing a famous historic or modern racing or sporting car will be transfixed in admiration by those sleek or majestic lines. The character in the complete design is what attracts to a very large extent, thus I feel miniature motor racing must borrow that character and attraction from its grown-up relative, and conduct not its feast of speed encased in any body shell its power unit demands, but a more realistic fill of racing at lower speeds on a three or four car circuit, the participants being obliged to pay as much attention to the realism of their cars in general appearance as they must give to those cars' motive power.

I am aware, of course, that, thanks to Henri Baigent who has designed such a circuit, a big step forward in the right direction has been made, and THE MODEL ENGINEER has asked me to build a 1/12th scale model of the famous Alfa Romeo type 158 powered with a 1.5 Frog engine which may, I think, be described as a formula 1 Miniature Grand Prix car eligible for racing on the type of circuit just referred to. During this article, and in subsequent issues of THE MODEL ENGINEER, I shall be describing the building of this model, and I do hope that the various gentlemen who have objected to space given to model racing cars will bear with me for a little while.

My approach to this deeply interesting work is one of ruthless determination that first and foremost this is to be a model of an Alfa Romeo. Secondly, the building of the model shall be as simply contrived as possible, so that others who may desire to build Formula 1 cars, and I hope many will, can do so without considerable designing difficulties, thus winning over builders of detailed static models, and swelling the numbers for Formula 1 events.

Now about the model—in my view I think that the amount of detail which should be included should be the amount of detail that may be seen on the real car by a spectator at grand stand range. Thus we should have a perfect body contour. The correct character of the radiator grille, front suspension and springing—wire wheels, knock-off hubs which revolve with the wheel, louvres, exhaust pipe, wind screen, steering wheel, instrument panel and driver, etc. The complete car must be delicate and thoroughbred in appearance, but extremely strong in fact. It should have the personality of—in this case— the Alfa Romeo, and for this reason should be a balanced blend of the artistic static model and the functional powered model.

After careful consideration I decided that the



The 158 Alfa Romeo specially adapted for miniature Grand Prix

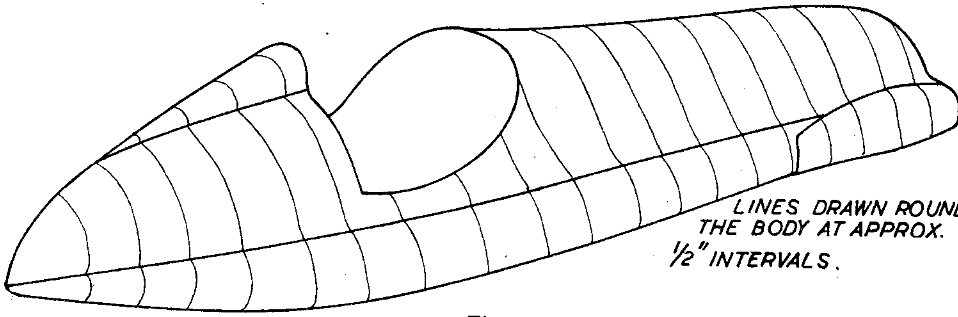


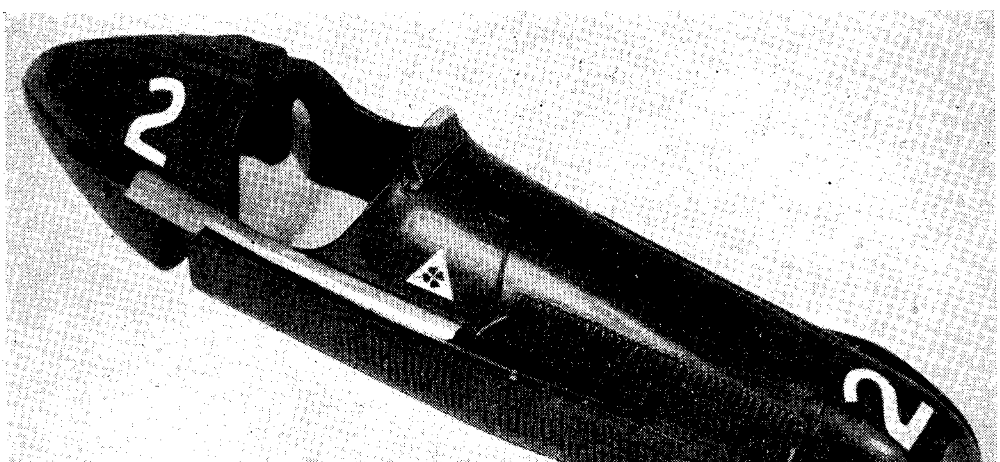
Fig. 1

body shell must be formed in wood, because I believe that the complicated and subtle contours of the modern Grand Prix car can better be reproduced by carving than by forming any other way. When I said body shell I meant just that; externally it must be correct, not deviating a singe line or angle to accommodate power unit or anything else. Internally it must be hollowed out from nose to tail.

This body shell, carved from the solid piece of french lime to the finished shell took 56 hours. The procedure was as follows—card templates were taken from my drawing of the body outline side elevation and plan, and applied to the block of lime and traced round with a pencil, and the resultant silhouette sawn out. This done, it remained for me to carve the block down slowly and carefully to the body section templates.

Now a word about these section templates, and in order to concentrate on this item, may we move for a moment to Silverstone. There accompanied by Richard Russell, my colleague, armed with camera and sketching book, and having made friends with the Alfa personnel by means of voluble Italian spoken with the arms only, we were permitted to do anything we liked with any car we liked, barring taking it home, and accompanied by beaming mechanics and drivers we photographed, sketched and absorbed the personality of the 158 Alfa Romeo.

The reason I have included this little diversion is this; that only if I am obliged to for some reason do I rely on my own first drawings. I carve to the template I have considered correct. Perhaps it is but very often the effect in three dimensions isn't quite what I feel it should be, and I correct the faulty angle on the model until I feel satisfied that I "recognise" it, and then correct the drawing. By this method the model and the drawing are built up together—



The completed body, ready for fitting to chassis

a little unorthodox perhaps, but I find that it works very well, and to see the actual cars in the natural surroundings helps me to photograph on my mind the personality of the subject being modelled.

The body of the Alfa Romeo is much more difficult to fashion accurately than it at first

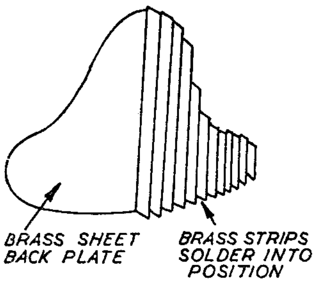


Fig. 2

appears. To start with, no two 158's are identical in external appearance. They may appear so at a glance, but upon examining closely and photographing four cars I found that scuttles and cockpit farings were different, front suspension cowlings were different. One car had one of each kind, giving a most lopsided appearance. Radiator grilles were different, and bonnet openings were different on the exhaust side. This is, of course, by no means unusual in Grand Prix teams. I remember clearly, for instance, that the 1923 G.P. Sunbeams were all slightly different.

There isn't really a great deal one can say about the actual shaping operations, except that I personally use chisels for obtaining what I call the "shaped oversize" of the final form. Thereafter I use a medical scalpel with a rubber handle fitted so as not to damage a nearly finished surface by inadvertently letting any portion of it come into sudden contact, as it sometimes will. The photograph shows the finished and adorned body shell. The final forming is a long business of very careful carving, remembering all the outstanding features, but exaggerating none.

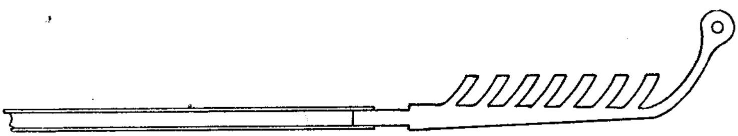
The Alfa Romeo is packed full of contours that ask to be exaggerated—that characteristic tail—the front suspension cowlings, and the waistline bulge, which in fact isn't a bulge at all, and on the real car is so small that it can hardly be measured. However, the final shape slowly emerges little by little until, having closely examined the real car, and having its characteristics photographed in one's mind, one finds one can "recognise" it again in miniature.

This static and very solid bodywork is now attacked from the inside before any final finishing occurs on the outer surfaces, and by placing it in the vice well wrapped in baize, it is very carefully hollowed out with gouges and chisels from nose to end, including the tail, for this body shell must fit exactly on to the powered chassis, and must be a complete unit in itself, as shown in the photograph, comprising the radiator grille, exhaust system (dummy), windscreen louvres and cockpit furnishing, etc. It must be really well finished, and have the delicacy in appearance that the first-class static model has; but must, in fact, be immensely strong.

This hollowing out process lightens the bodywork enormously. The hollowing out incidentally includes the radiator and exhaust pipe apertures, and, of course, the cockpit.

Having satisfied myself that I had taken all that one could afford in the interests of strength from the interior, I turned again to the exterior, and began the process of balancing the contours by means of lines drawn round the body from nose to tail at approximately $\frac{1}{4}$ in. intervals, chipping away a little here or there until satisfied that the contours were true on each side. (Fig. 1.)

At this stage the whole body was rubbed down to a very smooth finish, after which two coats of shellac were applied and rubbed down again. Then the body and bonnet joins were cut in and worked on with a knife-edge file, and the louvres fixed. At this point model engineers, who read these words, must take a firm grip on themselves to prevent any possibility of hitting the ceiling, for as I said earlier this powered model must be a blend of artistic effect, and the functional. We are, at the moment, engaged on the artistic effect. The louvres are made from cardboard strips, each length well shellaced, and cut to the correct size. The location on the body where the louvres appear is painted with a very smooth coating of glue, and each louvre placed into position. When dry, the top and lower ends of each louvre is cut into a louvre shape, and the delicate work of blending them into the bodywork begins. This is accomplished in the following manner: The louvres are sand-papered with No. O paper top and bottom, the first treatment being applied up and down, i.e., so that the louvres are "worn away" top and bottom. A coat of shellac is then applied, allowed to dry, and the careful top and bottom process continued. It is very important to paint the whole area of bonnet covered in louvres with shellac, because it softens the glue and disperses it so that no knobs of glue are left between each louvre. By this means, and after about six or seven applications of shellac the louvres, firmly bound by glue and shellac, will look exactly as if they have been carved out of the solid bodywork. They are immensely strong, and could hardly be more effective. So strong are they, in fact, that one may now shellac the whole bodywork again, and continue rubbing



THE EXHAUST SYSTEM IS FORMED IN BRASS ROD AND TUBE

Fig. 3

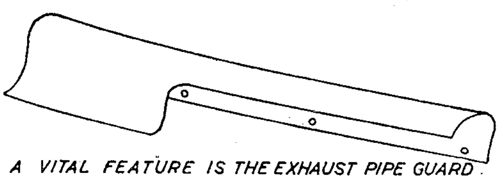
down, completely ignoring the louvres which are now part of the shell, and one can sandpaper them with the body without any distructive consequences.

Now for the non-functional attachments to the bodywork. First the radiator grille. This being located out in front must again be typical in appearance, but very strong, and it is made from thin brass strips in the following manner. A backplate is formed to the correct contour, but slightly smaller than the aperture in the nose which, when formed, incidentally, was tapered towards the back ; thus the backplate would be located just inside the shell of the radiator cowling. To this backplate are soldered strips of thin brass placed on edge and stepped in accordance with the grille shape (Fig. 2). This preliminary grille is then introduced to the radiator opening and the fitting checked—thereafter the whole structure is formed by fitting to shape, taking into consideration the side elevation contours, and the plan contours.

The cross-bracing strips are formed by filing slots right across the whole grille and soldering into these slots fine brass wire. The completed grille not only looks very realistic, but once again is exceedingly strong, and when in position is virtually undamageable. On the real car this grille is painted with silver paint, but on the model it must be dull chromed, as paint is liable to peel off if knocked at any time.

Next the exhaust pipe. This is formed in brass rod and tube, the rod being turned down to a taper at the manifold end, and the pipes attached by soldering. It is turned down at the rear end to fit into the tail pipe. Fig. 3 makes this quite clear, I think. It also shows that the extension of the manifold end is beaten flat and drilled so that the manifold may be screwed into the shell interior. The multiple pipes are kept short and do not protrude into the body interior for fear of fouling the chassis parts. The tail-piece is secured to the body at the rear by a small bracket.

A very vital feature of the 158 or 9 is the aluminium exhaust pipe guard (Fig. 4). This is formed in aluminium, and as it is to conform to the outline of the body it must be gently beaten to shape. It must have a flange at the back for



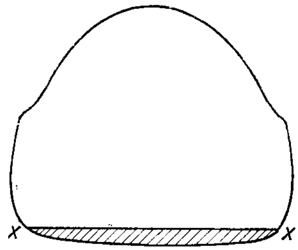
A VITAL FEATURE IS THE EXHAUST PIPE GUARD.

Fig 4

fixing to the body, and must be deeper at the rear end to protect the tyre from undue heat radiation from the exhaust pipe.

The windscreen frame is formed in fine brass tube, the inside being filed out so as to leave a channel for the screen itself. The screen is then fitted with an adhesive known as Bostic, and the frame is carefully beaten on to the screen edges. The plating of the frame is sacrificed to ensure greater strength of the whole unit. The screen frame mounting is pinned to the scuttle, and the windscreen, to the back of which incidentally have been soldered two 12 B.A. screws for mounting, may now be placed in position. Naturally, with all the other attachments, it is removed before spraying.

Now may we, for the purpose of this article, suppose that the chassis has been constructed, at any rate as far as the wheel base track and track-



CUT AWAY BENEATH LINE X-X

Fig. 5

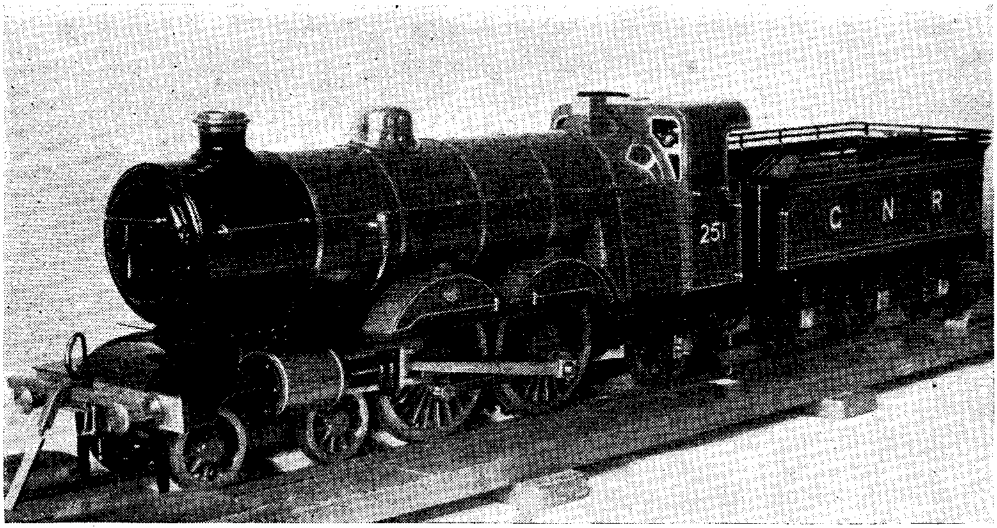
rod is concerned. The last operation on the body, therefore, is the cutting out of the apertures to accommodate these members. After this is done the body shell unit is ready for spraying. The surface is so perfect that no undercoat is needed ; in fact, it mustn't be applied for fear of the final coats filling up the detail. Thus we apply a very thin preliminary coat of red cellulose followed, when dry, by a further five coats, the final coat giving a finish indistinguishable from the finest plastic. This is the reward of the seemingly endless earlier rubbing down with coats of shellac.

We have almost finished in the artistic effects department, but there is one further vital note. The ground clearance of this model must, because of its functional purpose, be larger than scale. The effect to gain, therefore, is to give this excessive ground clearance, but to lose nothing in the general appearance of the low build of the car, and thus give a sufficient ground clearance, and at the same time not lose the personality.

This was achieved in the following manner : The whole body was modelled as if for a static scale model, it having been noted beforehand just how the very small ground clearance occurred. The illustration of a section through the body shows that this ground clearance (4 in. in the real car) occurs mainly on and after the lower extremities of the under cut. Take the line X-X in Fig. 5 and cut it away, and one will still have 9 and 9/10ths of the bodywork accurate and correct. The external underside when taken away leaves a sufficient extra clearance to accommodate the functional apparatus, leaving sufficient undercut to the body sides to give the body work complete accuracy at all points, except the extreme underside, which gap is filled by rail and apparatus. The ground clearance, which is 6 in. instead of 4 in. is hardly noticeable, and the car still achieves its low built sleek appearance so typical of the Alfa Romeo 158.

(*To be continued*)

Exhibition at Southampton, 1951



Mr. E. Salt's 3½-in. gauge Atlantic, a first attempt, winner of the Loco. cup at the Southampton Societies' exhibition

ONE of the finest model shows ever held in Southampton was recently displayed at the Central Hall, St. Mary Street, and being also blessed with fine weather, it was a success from the start.

Close team work from all club members was required as only about one and a half hours were available to put the show on, and entirely remove it when it was over. That the operation was accomplished without confusion, proves the value of committee work, as over 200 models were involved, ranging from a 7¼-in. gauge locomotive downwards. In view of the large number of marine models, these were housed in an annex.

Sir Robert Wood, K.B.E., C.B., M.A., the vice-president, performed the opening ceremony, praising the general excellence of the models and stressing the value of the reserve of skill available to the nation during times of emergency.

Southampton received great support from the Southern Federation—Totton, Andover, Salisbury, Eastleigh, Chichester, Fareham and Isle of Wight model engineering societies.

A great many locomotives, finished and unfinished, were on view, including Mr. Moody's (Totton and New Forest M.E.S.) veteran 3½-in. gauge locomotive, Mr. E. Salt Jnr. (home club) G.N.R. Atlantic, a very worthy first attempt. Mr. Digby's (home club) 1¾-in. gauge "Diana" had very neatly finished oxydised platework. Mr. G. H. Thomas (Totton and New Forest) had on view his partly finished "Heilan' Lassie" chassis, in 3½-in. gauge—a superlative piece of work, beautifully finished down to the last nut.

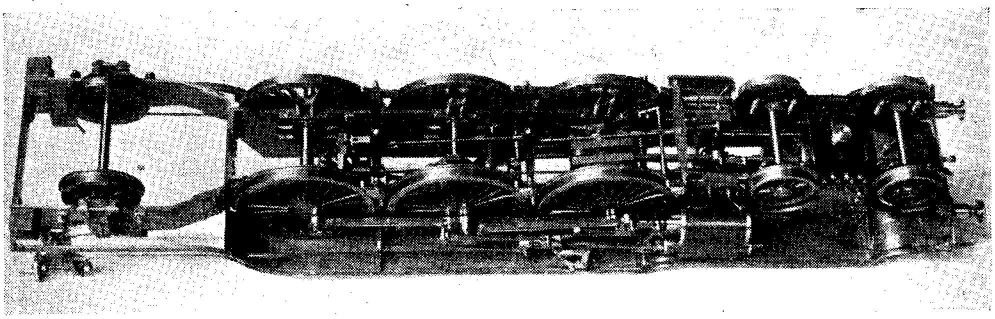
Traction engines were well represented, the most noteworthy being Mr. Balson's (home club) 1¼-in. scale double-cranked compound engine and his 1½-in. scale Burrell "Light Devonshire" single-crank engine. Mr. O. T. Wicks, of the Andover society, had on view his celebrated showman's engine. Any of these would delight the eye of the traction engine connoisseur. The traction engine is a popular fancy with the model engineer and a great many were on view.

In the general section Mr. J. Butler, of the Totton and New Forest Society, displayed his four-cylinder flash steam engine and Mr. H. Puntis, of the home society, his four-cylinder o.h.v. petrol engine. Mr. G. Gerrard, a free-lance Southampton model engineer, had two models on view, an "O" gauge Southern mixed traffic electric locomotive and a model of a Cooper race car, complete with a fiercely moustached and well visored driver; both of these models bore the touch of a masterful hand.

In the tools and appliances section Mr. Thomas's (Totton and New Forest M.E.S.) swivel vice was greatly admired, as was his midget scribing block. Mr. Martin (home club) entered a selection of "tools for the job" including tools to make tools!

The model aeroplanes on view were from the Southampton Model Aeroplane Club, which at one time was incorporated with the Southampton and District Society of Model Engineers.

Mr. Finmore, of the home club, was officer in charge, compressed air operations, and kept the wheels turning to the satisfaction of young and old. He was assisted by "Pop" Cannon, the Southampton Society's oldest member, who had on view *five* locomotives, two traction engines and a large number of working model stationary



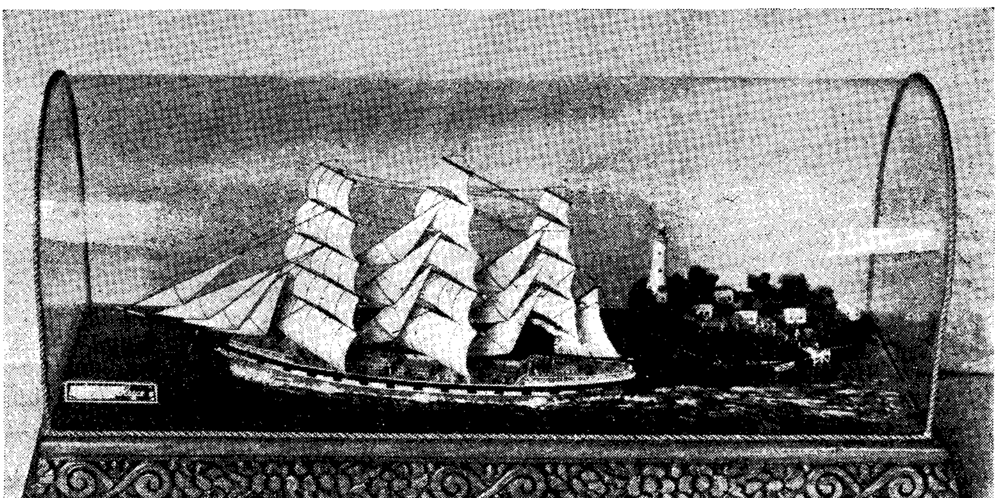
Mr. G. Thomas's unfinished "Hielan' Lassie" chassis, a loan exhibit at the show

engines. At 75 years of age, he is still making engines—and on a treadle lathe, too!

It is only to be expected, that in a seaport town like Southampton, model ships and boats should be prominent, and such was the case. A fine example was Mr. H. Owens's (home club) radio-controlled *Capetown Castle* with everything on board except the provisions! The same could be said of Mr. Bosberry's (Fareham Society) Vosper M.T.B., an outstanding model which needs no introduction to visitors to the "M.E." Exhibition. A fine coal-fired steam launch on view was the work of Mr. Finmore, of the Southampton Society, and which pond users can verify, gets along in a most realistic fashion! Another local member, Mr. J. Dicker, exhibited his partly finished paddle steamer, a scale model of the S.R. Company's *Shanklin*, which was much admired. Mr. J. S. Lindsay, hon. secretary of the Southampton & D.S.M.E., had on view two waterline models, one a steam yacht and the other a collier, and a full model of the sailing barque, *Pher Ugland*, all displaying neatness of finish. A highly decorative scenic model of the full-rigged ship *Golden Fleece*, with a wealth of small detail (all the crew, on a ship about 6 in. long), attracted a great deal of attention. It was the work of Mr. T. Chalmers, of the local society.

A great variety of different types of craft were on view, including several model hydroplanes. Of these, Mr. Pilliner's (home club) highly original *Frolic* aroused considerable comment. A very clever piece of junior work was Mr. H. Walshaw's (home club) sailing dinghy *Kittewake*.

It was regretted that such a small percentage of the large number of models were entered for competition. Apart from this, however, it was a show about which the Southampton and District Society of Model Engineers could feel justly proud.



Mr. T. Chalmers' 50 ft. to 1 in. scale model of the "Golden Fleece," winner of the Peridot Cup

AN INTERESTING MODEL BEAM ENGINE

by J. W. Fairmington

SOME time ago, I had the loan of an old model beam engine belonging to a gentleman 89 years old. He had got it from an uncle when he was a boy, so that will give some idea of its age. I have had it photographed, and three different views of it are reproduced.

I am inclined to think that it has been a demonstration model ; the cylinder has never been finished inside, and there is a handle for driving purposes.

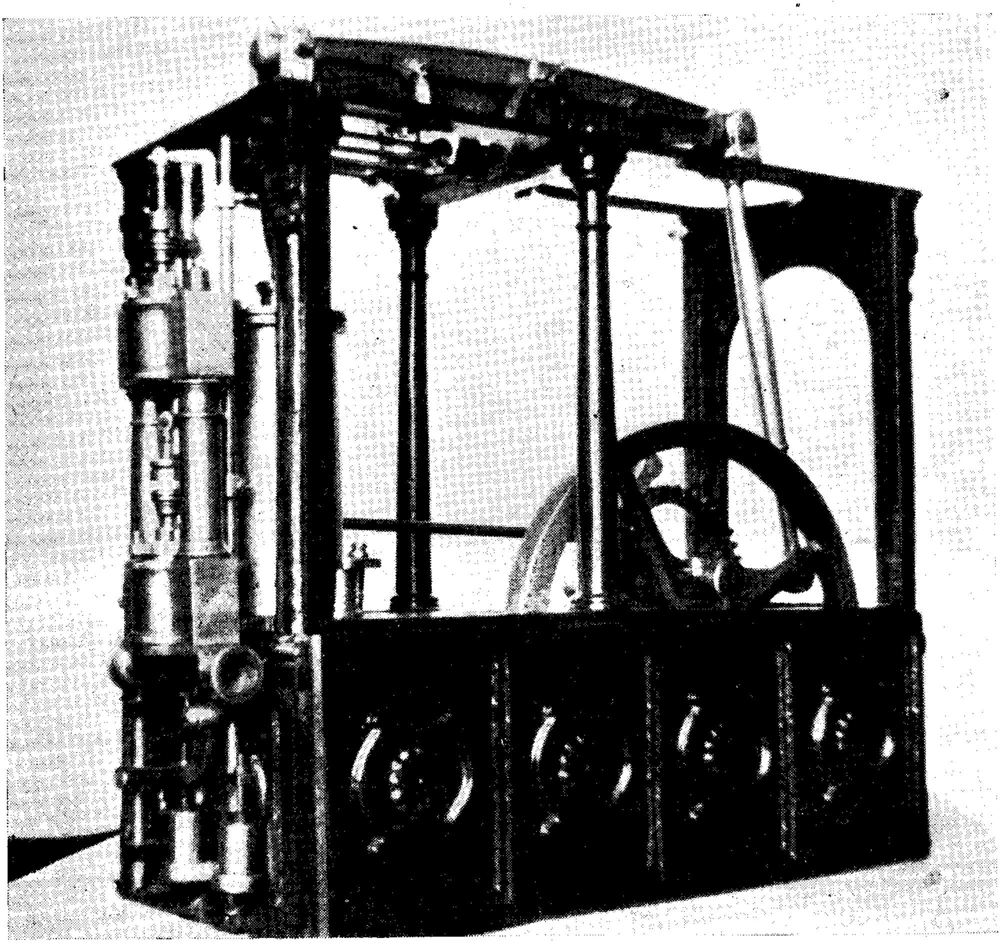
The valve mechanism, driven through bell-cranks from an eccentric on the crankshaft, works two push-rods, one of which lifts the inlet valve in the top steamchest and the exhaust valve in the bottom steamchest. The other rod performs the reverse operation.

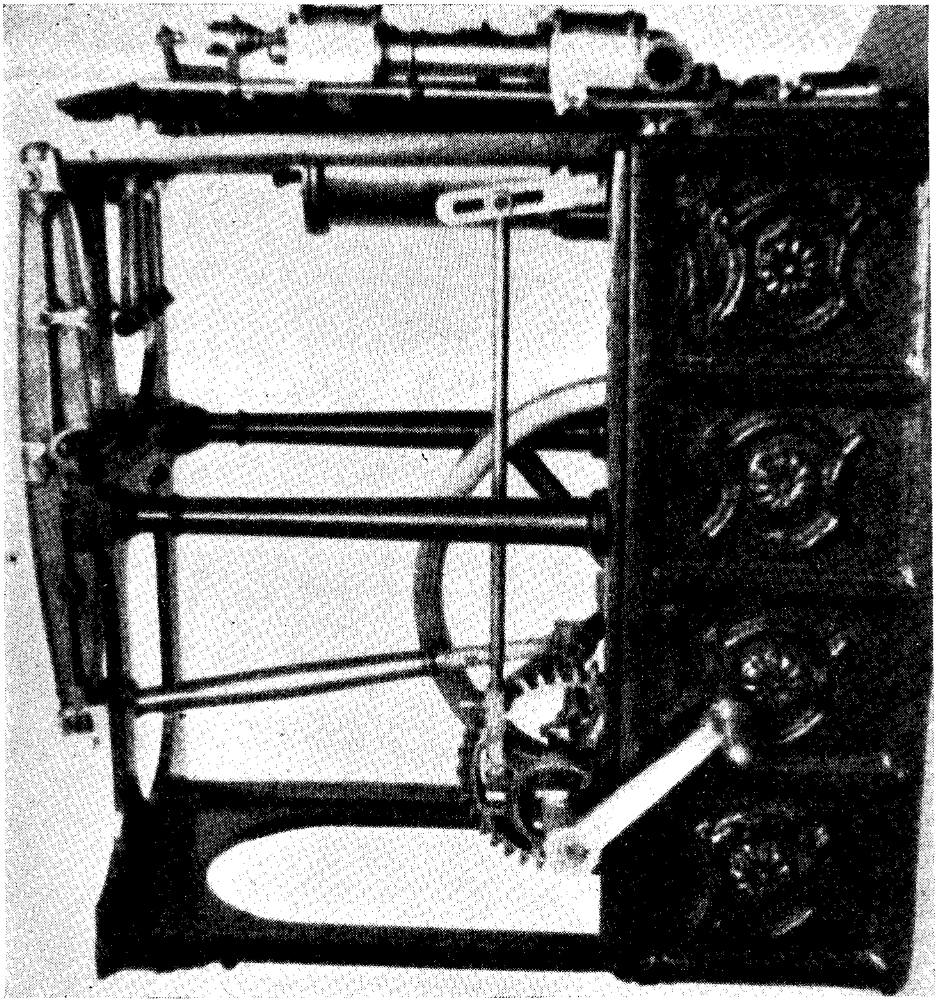
The valves are of mushroom type, the inlet valve sleeve passing down through the centre of the exhaust valve stem.

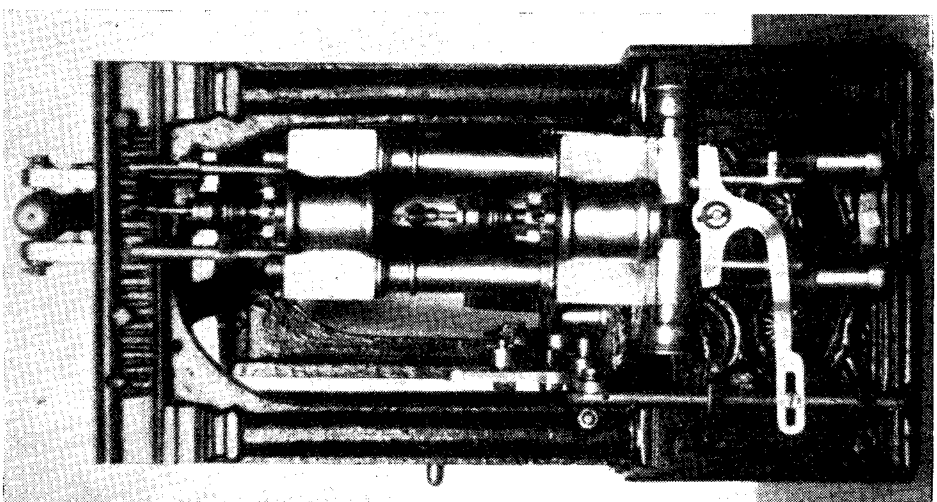
Springs at the bottom of the push-rods close the valves, as shown in one of the photographs. Steam is admitted by one circular column and exhausted through the other.

The flywheel is mounted on a countershaft driven by gears giving a step-up ratio of 4 to 1.

The model is 18 in. long, 9 in. wide and 16½ in. high. The cylinder is 2¼ in. diameter by 4 in. stroke.







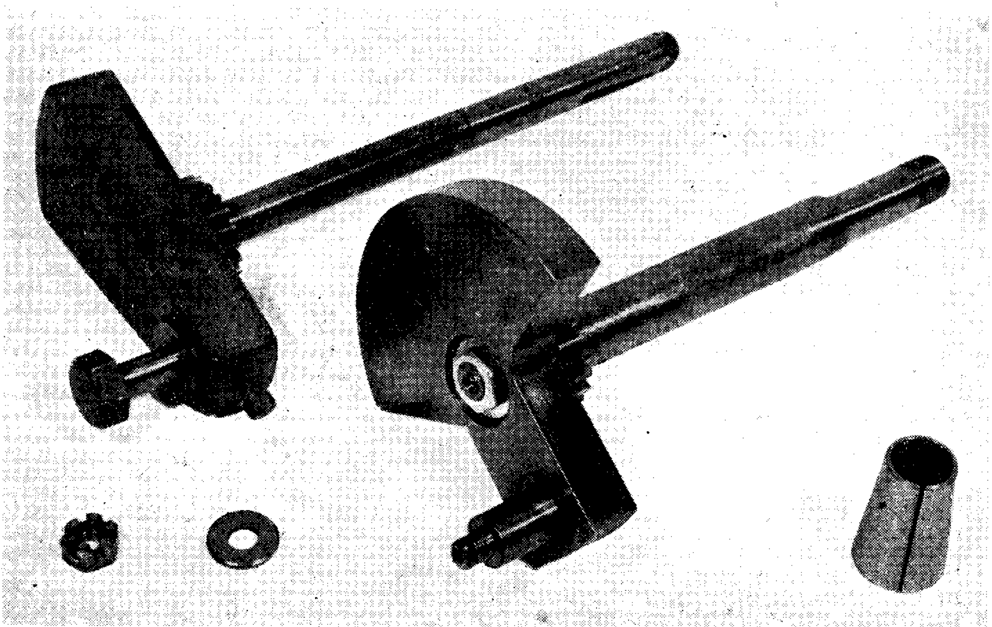
PETROL ENGINE TOPICS

*"New Engines for Old!"

How an Ancient Gas Engine was Improved, Modernised, and Given a New Lease of Life

by Edgar T. Westbury

ONE of my tame critics has raised a rather curious point regarding the flywheel of this engine; he suggests that it runs in the wrong direction, or alternatively, that it is wrongly designed for the direction in which it runs. As I did not design this component, I can legitimately disclaim all responsibility in this matter; but the idea is quite a new one to me, and I should be interested to know if other readers have any views on the subject. Briefly, the criticism concerns the "lie" of the curved spokes, which, it is suggested, should be disposed so that they are in compression under working load, in view of the relatively low tensile strength of cast-iron, which is unsafe to take load in tension.



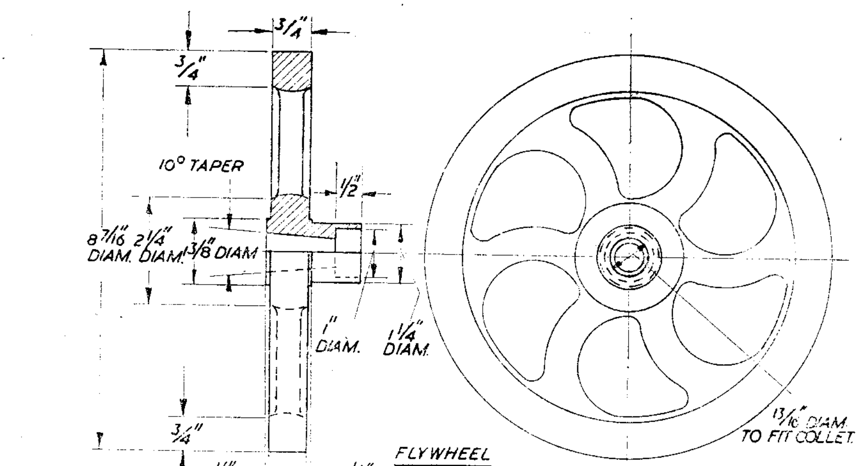
The original crankshaft, and the new crankshaft, with crankpin nut and washer, and flywheel collet

Frankly, I think there is room for some doubt whether the spokes of such a flywheel are in tension or compression under working conditions. As most readers are aware, curved spokes are sometimes used merely for ornament, but the most common reason is to relieve stresses in the casting. A straight spoke, in a cast-iron flywheel, is liable to considerable stress when the casting cools, owing to the contraction of the heavy rim, and by introducing a curve in the spoke, it is possible for it to bow slightly and relieve this stress. I was under the impression that this was the only *practical* reason for the curved spokes.

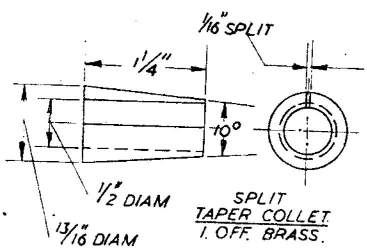
In this particular case, it will be seen from the drawing that the curve of the spokes is not based on a tangent, but that the chord of the arc is nearly a radial line; in other words, the curve has no appreciable "rake" or "trail" in relation to the direction of rotation. Therefore they cannot be said to be really in compression or tension; the stresses in the spokes do not alter in direction, in relation to that of the torque load applied to them. Another, and a very important considera-

*Continued from page 713, "M.E.," November 29, 1951.

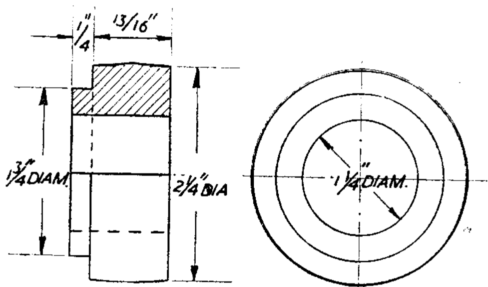
tion is that the function of the flywheel is to store kinetic energy, and thereby enable the engine to carry on with the minimum change of speed during the idle strokes. During the firing stroke, torque is applied from the shaft to the flywheel hub, and transmitted through the spokes



FLYWHEEL



SPLIT TAPER COLLET 1 OFF BRASS



BELT PULLEY

to the rim; on the remaining strokes, torque is given back to the shaft, from the momentum stored in the rim, by way of the spokes, and the hub. Thus the torque stresses in the spokes are constantly changing in direction; this applies even when the rim of the flywheel is used as a driving pulley, but in this case it is not.

For this reason I cannot see that it matters much which way the flywheel spokes are curved. If the flywheel were symmetrical on its two sides, and parallel bored, it could of course be reversed on the shaft, but this cannot be done in the particular case. It may be remarked that nearly all horizontal stationary engines run clockwise, when viewed with the cylinder on the left; one good reason for this is that this keeps the side thrust on the piston downwards, and reduces the risk of piston slap.

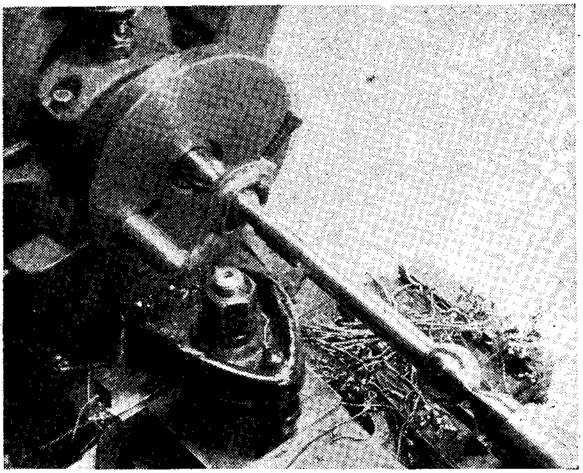
In order to test the engine under load, a driving pulley was made to fit over the flywheel extension boss; the dimensions are as shown in the detail drawing. It was simply made a press fit on the boss and no further fixing has been found necessary.

Connecting-Rod

It was decided to make the new rod from a solid mild-steel bar, with spherical ends, and a tapered shank. The process of machining this was perhaps a little unorthodox, as instead of turning the shank first and shaping the ends afterwards, as might appear the more logical procedure, the order of things was reversed. In order to form true spherical curves at the ends, a simple radius tool, identical with that described some time ago in connection with the machining of THE MODEL ENGINEER universal vice, was utilised. A piece of 1-in. steel bar 6⅛ in. long was first faced up and centred truly at each end, being held at one end in the chuck and at the other end in the three-point steady. The pivot bolt of the radius tool was mounted on the cross-slide and the location of the centre for the ball end located by means of the removable gauge pin, the position of the slide, as shown by the saddle and cross-slide indices, being carefully noted; the tool radius, for each end was also set with the aid of the gauge-pin.

The ball end was first turned parallel, to the maximum outside diameter (at the big-end this meant only a mere clean up), and necked behind the ball to slightly over ½ in. diameter. It was then quite a straightforward job to form the contour by swinging the radius lever, taking care

to finish with the slides set at the previously noted index marks; the result was an excellent finish, and assured accuracy of shape.



Preliminary parallel turning of the connecting-rod shank between lathe centres

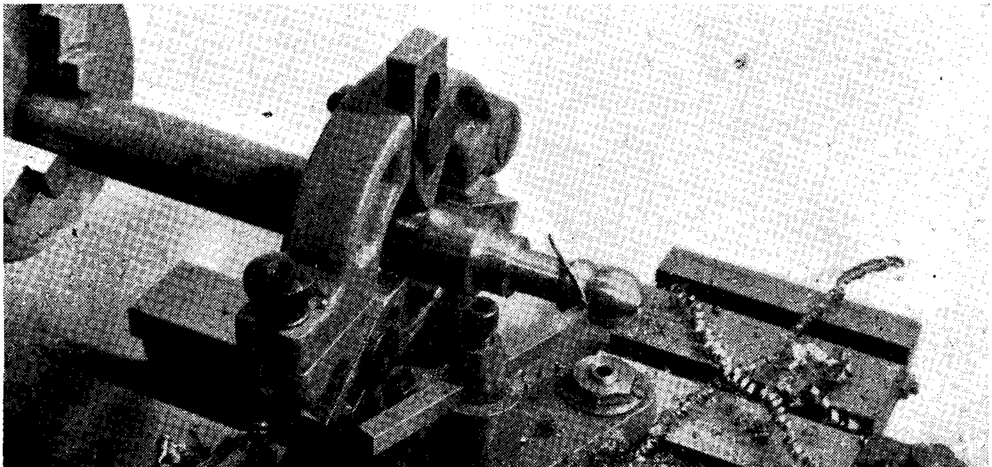
Cross-Boring the Eyes

The next operation consisted of running the rod between centres and turning it down *parallel* to a few "thous'." over ½ in. diameter; the reason why it was not tapered at this stage was to simplify the means of mounting and setting up for the operation of cross-boring the two eyes. For this operation, the vertical-slide was employed, set up on the cross-slide, and its face set exactly square with the lathe axis by careful measurement, using the faceplate, in position on the mandrel nose, as a reference surface. The rod was then clamped across the vertical-slide, locating positively in one of the tee-slots, and held in place by two slotted clamps.

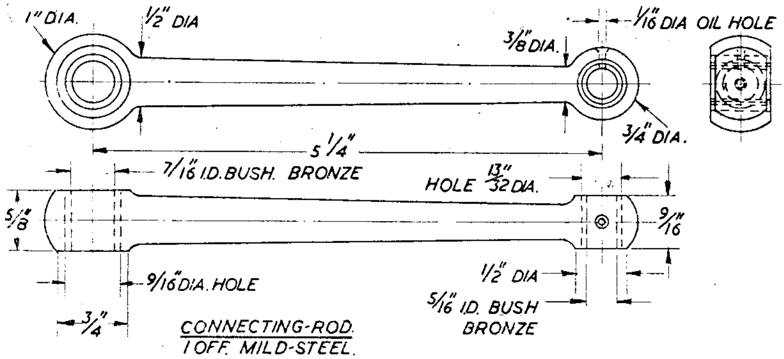
Here it will be apparent why the shank of the rod was left parallel; had it been tapered, it could have been held in the same way, but setting the axis square with the lathe axis would have been far more difficult, with no positive check on accuracy possible. A still worse objection is that individual setting of the two ends would be necessary, with the risk of getting them out of truth with each other. With the shank left parallel, accuracy can be quite positive and it is only necessary to shift the vertical-slide to the front of the cross-slide and re-check from the faceplate after one eye has been bored.

The vertical and lateral position of the eye was thus very easily adjusted to centre the boss with the lathe axis, but before centring and drilling, an end mill was used to produce a small flat on the boss. The object of this was to serve as a "witness" when starting the centre drill; a flat formed on the surface of a true sphere must necessarily be concentric with its outer contour, and if the drill is started *exactly* in the centre of the flat (which can easily be checked visually) it must necessarily pass straight across the diametral centre.

To guard against any possibility of the drill wandering off centre, the eyes were bored with a small boring bar, and the ends faced with a spot facing cutter, as illustrated in the photographs. It will be noted that unless a left-hand cutter is available, the lathe will have to run in reverse for dealing with the back face, but as only a few revolutions of the cutter are required, it can be pulled round by hand if no provision for power reversing is available. The operations on the two eyes are, of course, identical, except for the dimensions of the bores.



Turning the spherical curve on the small-end of the connecting-rod



For the final operation on the rod, it was placed between centres again, with the tailstock offset to produce the required degree of taper—slightly under $\frac{1}{8}$ in. to the foot on the radius—though this figure is not critical, so long as the ends of the shank blend smoothly into the contour of the bosses, with a neat fillet at the junction. The eyes of the rods were bushed with plain bronze bushes, made a fairly tight press fit (as there was no danger of bursting the eyes), and an oil hole was drilled and countersunk in the little end, but not in the big end, as this is lubricated by way of internal passages in the crankshaft.

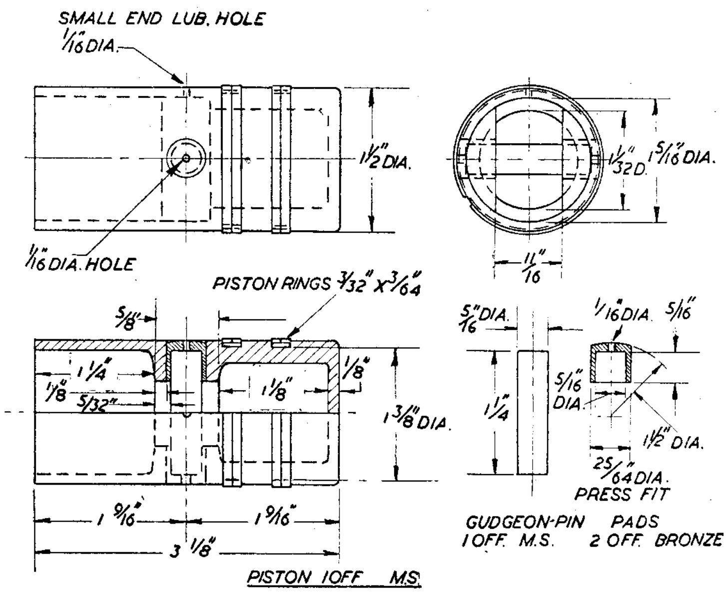
The Critics Again !

A further criticism has been raised regarding the design of this connecting-rod, which, we are informed, is not " correct gas engine practice." Well, there are many components of this type of engine which are somewhat unorthodox, to say the least, and I think it is rather splitting hairs to pick upon this item in particular as being incorrect. As the crankshaft is overhung, there is no need for a split big-end bearing, and to provide one would not only be superfluous, but would also be adding more weight to be balanced out at the crankpin. But if we examine the matter more closely, there is some doubt as to what " correct gas engine practice " really means. I have worked on a very wide variety of engines in this class, and examined drawings of many more, and I can assure my critic that they vary enormously in details of design, even when superficially very similar in general appearance. Many components in gas engines were copied or adapted from contemporary steam engine practice ; in the case of connecting-rods, these were often of the " marine " type, having a turned tapered or bellied shank, with a solid small-end, with or without means of adjustment for wear in the bush, and a flat foot at the big-end, to which split " brasses " were attached by two or more bolts.

In a small engine designed mainly for utility, simplicity of working components is an important virtue, provided that they perform their function efficiently ; and I think most readers will agree that both conditions are fulfilled by the component in question. I am, however, fully amenable to discussing these details of design ; they are, admittedly small points, which may not have much effect on the success or efficiency of the engine when taken individually ; but engine design is built up from a multitude of details, all of which contribute something to success—or failure !

Piston

As already stated, the original piston has been retained, but some modification of it has been found desirable. In the first place, no rings of a suitable size to fit the wide (5/32 in.) grooves were available, but it was possible to obtain standard rings $1\frac{1}{2}$ in. diameter by 3/32 in. wide, and it was therefore decided to skim out the grooves a little wider still and fit two rings in each groove. Incidentally, this was once a fairly common practice, for which many virtues



were claimed, though it is rarely seen in modern engines.

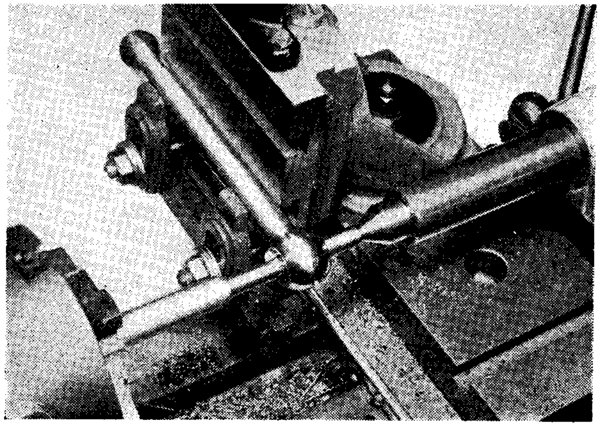
Secondly, it was considered desirable to fit a larger gudgeon-pin, and a check of the existing cross-hole in the piston showed that it was neither in the centre of the diameter, nor square with the piston axis. It was therefore necessary to correct this hole, which entailed the necessity to open it out large enough to introduce a small boring-tool. The piston was therefore marked out with the surface-gauge, to produce a longitudinal centre-line along each side and across the crown, square with the internal faces of the gudgeon-pin bosses; the existing hole was plugged so that a new centre could be found for setting up.

The piston was then mounted in the Keats vee-angle plate, the centre-line across the piston crown being set truly square with the mounting face; it was then mounted on the faceplate, and set up to bring the new centre true with the lathe axis. In the operation of truing up the bore, the front boss was first opened out to clean up, and to admit a 11/32-in. drill a tight fit; this was then cautiously fed in to open out the hole in the rear boss as truly as possible. In spite of all precautions, however, the tendency of the drill to follow the untrue hole could not be completely eliminated, and it was found necessary to open out both bosses to no less than 25/64 in. diameter to ensure a perfectly true parallel bore.

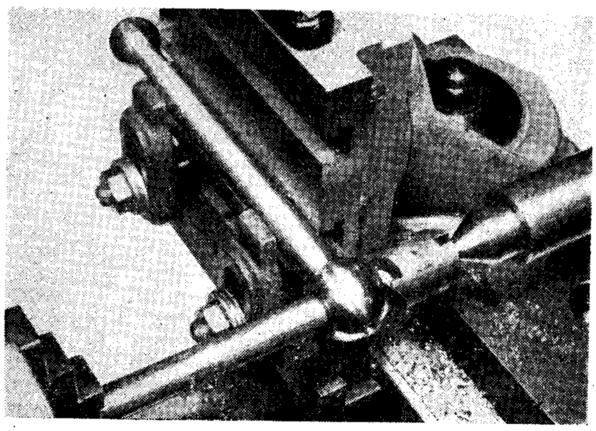
Unusual Bushes

As this size was larger than the greatest permissible diameter of the gudgeon-pin, it was then necessary to fit bushes to the bosses, and the rather unorthodox idea of making them in the form of blind caps, to enable them to be used also as protecting pads to prevent the risk of the gudgeon-pin scoring the cylinder walls, was adopted. The bushes were made a press-fit in the piston, with the end faces slightly rounded, and holes drilled in them to enable oil to be scraped from the cylinder walls to assist lubrication. A plain $\frac{5}{16}$-in. mild-steel gudgeon-pin, drilled through the centre and case-hardened, was fitted; it is a floating fit in the two piston bushes, and also the little-end bush. To ensure lubrication of the latter, a hole was drilled in the piston, immediately over the gudgeon-pin; as this hole runs past the cylinder oil feed pipe it receives oil which drops through into the countersink in the little-end of the connecting-rod.

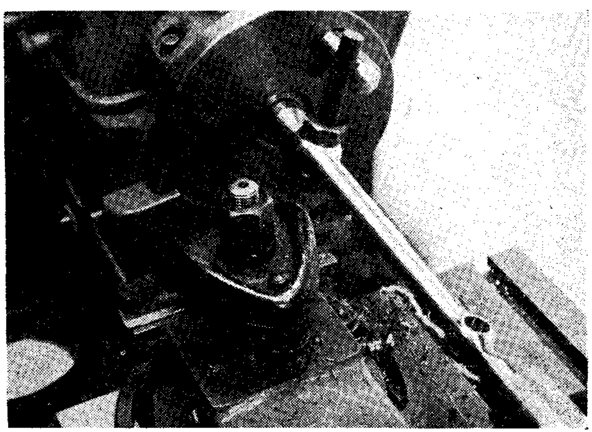
(To be continued)



The rod set up on the vertical slide for cross-boring the eyes



Machining the end faces of the eyes with a facing cutter

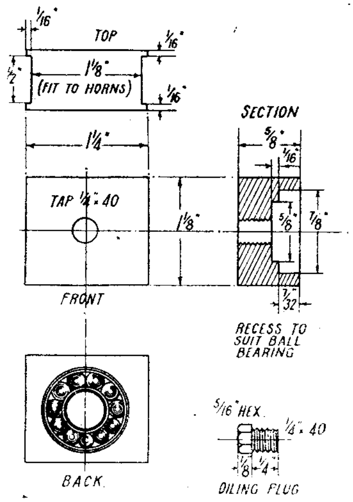


Taper turning shank after boring the eyes

"L.B.S.C.'s" Beginners' Corner

Driving Car Axleboxes for "Tich"

IN making and erecting the running gear of this small driving car, beginners who have successfully completed *Tich*, will be enabled to put their acquired knowledge and experience to practical use ; so it won't be necessary for me to set out the whole rigmarole in full detail again. This will speed up both the description and the job, as the parts are made and fitted in much the same manner as the similar components on the



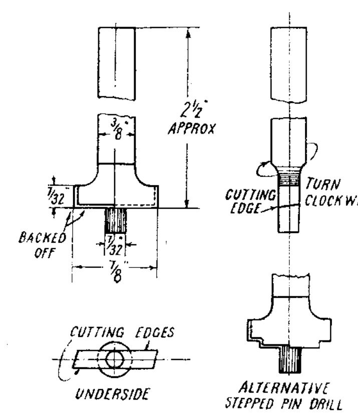
Details of the axleboxes

engine. The axleboxes may be made from castings or bar material. While bronze or gunmetal boxes are naturally desirable, they are not essential ; cast-iron, or steel bar may be used, but it doesn't alter the method of machining and fitting. I wouldn't advise the use of aluminium for the boxes of a passenger-carrying car, because they would rapidly wear in the hornblocks. The reason is apparent when it is realised that the eight axles are carrying proportionately the full load of a twelve-coach train !

The cast axleboxes will probably come in the form of a stick, and the side grooves are machined up in precisely the same manner as I described in full for *Tich* ; that is, either mounted on the top-slide under the toolholder, or on a vertical slide attached to the lathe saddle, and operated on by an endmill in the three-jaw. They can also be mounted in a machine-vice, either a regular one, or improvised from bits of angle and bolts (also described and illustrated) bolted to the lathe saddle, and traversed under an end-and-face cutter mounted on a spindle or arbor between lathe centres. If the stick is too long for the movement of your cross-slide, cut it in suitable pieces. If bar material is used, a piece of bar ⅝ in. × 1¼ in. section will be needed, and about 10 in. long, to allow for cutting up ; the grooves are milled out, as mentioned above. They can also be formed in a shaping or planing machine, with a square-ended tool about $\frac{3}{16}$ in. wide in the clapper-box, taking the groove out in three instalments, $\frac{3}{16}$ in. at a time, with a slight overlap ; but it's a patience-trying job ! Castings would, of course, have the grooves cast in, and could probably be cleaned up to fit the horns, by judicious use of a file. They would also require smoothing all over the outside ; but boxes cut from bar material would be smooth enough without any further treatment. Boxes made from cast stick, or bar, may be parted off in the four-jaw chuck ; alternatively, they may be sawn off, and the tops and bottoms finished by chucking in four-jaw and facing off with a round-nose tool set crosswise in the rest. Mark the horn slots 1 to 8, fit each box separately to its hornslot, and mark the boxes to correspond ; this saves beginners a whole heap of trouble.

How to Drill and Recess the Axleboxes

Whereas the engine axleboxes had plain bearing holes through them, the car axleboxes have ball bearings, and this involves a little more care in machining. Incidentally, a word to the uninitiated—don't write and ask me if you can use



Pin drill for recessing axleboxes

plain bearings "for the sake of simplicity," as a well-known catalogue would say. The weight of an adult rider on eight small plain bearings would practically set them solid, and the little locomotive would have about as much chance of moving the car, as it would have of pulling the Eddystone lighthouse off its foundations. Ignorance of the relationship of load to bearing friction

once caused an amusing episode on a certain railroad in U.S.A. A number of 50-ton hopper cars were set out in a siding, to be loaded with pig iron. The loaders were new to the job, and not realising that the carrying capacity of the cars was rated by weight, and not by bulk, proceeded to pile in as much pig-iron as the hopper bodies would hold. You can guess what happened when an engine coupled on and tried to shift them! After vain attempts for about an hour, the crew uncoupled the end car, and found the engine could barely move it; then somebody went on top and took a look inside the hopper. History fails to record the ensuing remarks!

Mark off the exact centres of axleboxes 1 to 4, drill as described for *Tich*, either on drilling machine or lathe, and then use each box as a jig to drill its opposite mate, also as described, using No. 30 drill. Put each pair of boxes in place in the horns, and test with a piece of $\frac{1}{8}$-in. silver-steel through the holes, to make certain that the axles will be square with the frames, and parallel to each other. If "out," file the offending hole to bring it right, re-drill $\frac{3}{16}$ in. and test with a piece of $\frac{3}{16}$-in. steel. When all fours pairs of boxes are O.K., open out the holes to 7/32 in., but don't tap just yet.

The ball-bearings are a standard size, $\frac{7}{8}$ in. outside diameter, 7/32 in. wide, with a $\frac{3}{8}$-in. hole; and recesses have to be made for them in the axleboxes. The easiest way of doing this, is by pin-drilling. A suitable pin-drill is shown in the accompanying illustration, and it is easy to make. As it only has to form eight recesses, it may be made from mild-steel and case-hardened; but if you have a bit of $\frac{7}{8}$-in. round cast steel, why, use it! A piece about $2\frac{3}{4}$ in. long will be needed. Chuck in three-jaw, and turn down approximately $2\frac{1}{4}$ in. length, to a size that will fit your drill chuck, say $\frac{3}{8}$ in. diamter. Use a round-nose tool, and leave a radius as shown. Reverse in chuck, and turn down a full $\frac{1}{4}$ in. of the other end, to 7/32 in. diameter, a nice running fit for the holes in the axleboxes. Leave a length of 7/32 in. the full $\frac{7}{8}$ in. diameter of the original piece of round bar. File this flat on each side, as shown in the side view, until it is the same thickness as the pilot pin; then back off each side, and the bottom, to form cutting edges, as shown in the illustrations. Amateur toolmakers should bear in mind that the part that doesn't cut, must always be made to clear the part that does; if you look at one of your lathe tools, and note how every part of the tip backs away from the cutting edge, you'll see exactly what I mean, better than words can explain. Also, when backing off, which should be done with a fine file, be mighty careful to avoid filing the actual cutting edge, or you'll cattle up the whole works.

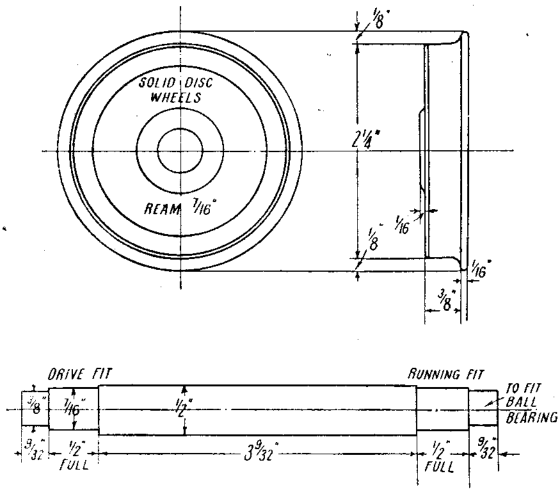
If the pin-drill is made from cast steel, it can be hardened and tempered in the same way that I have described for other tools, viz. heat to medium red, plunge into cold water, and then brighten up the two flats by careful application to your emery-wheel. The easiest way to temper this particular gadget, is to hold the lower end of the turned part in a gas or spirit flame, taking care that the flame is well away from the cutting edges. Then watch the colours travel down the bright part; and as soon as the yellow arrives at the cutting edges, pop the whole lot into the cold water again, and Bob's your uncle. The tool is then ready for use. If, however, you have used mild-steel—I've made plenty of mild-steel merchants for odd jobs—heat the business end to bright red, and roll it in some good case-hardening powder, such as "Pearlite," "Kasenit," "Ecosite," or any other reliable brand. Repeat the ceremony about three times, so as to get a good depth of case, and then reheat until the yellow flame completely dies away. Plunge into clean cold water, and you're all set for the recessing job.

Before attacking the axleboxes, have a trial run on any odd bit of brass that may be handy. Drill a 7/32-in. hole in it, put it in the machine-vice, and with the pin-drill in the drilling machine, or lathe chuck, as the case may be, insert the pilot pin into the hole, and feed in the pin-drill for $\frac{1}{8}$ in. or so. Try a ball-bearing in this shallow recess. It should just be a fairly tight push fit; not so tight that you can't pull it out again easily. If O.K., go ahead and recess the boxes, letting the pin-drill penetrate until the full 7/32 in. of the cutting part has entered. If the ball-bearing is a loose fit in the trial piece, grind the weeniest shade off each end of the cutting part, and have another try, using the same "dummy," and letting the pin-drill penetrate another $\frac{1}{8}$ in. If still too loose, have another slight grind; but the second trial usually works the oracle.

An Alternative Method

The recesses can be formed without a pin-drill, by boring, but this will probably take longer, as each bore has to be carefully gauged, to get the recesses all the same size and depth. Chuck the box truly in the four-jaw; you can do this in two wags of a dog's tail if you put a piece of 7/32-in. silver-steel, or a 7/32-in. drill, in the tailstock chuck, and put the axlebox on it, close to the chuck. Open the jaws of the four-jaw; run up the tailstock until the axlebox is in the jaws, then carefully close them down on it, pull away the tailstock, and the box will run truly. Put a square-ended tool crosswise in the slide-rest; the business end of the tool should be about $\frac{1}{4}$ in. wide. Then go to work just as if you were boring a cylinder, only don't let the tool penetrate more than 7/32 in. Start from the middle, and open out until the ball-bearing will just enter a fairly tight push fit. Don't push it right in, because a further recess has to be cut behind the larger one, to allow the centre part of the ball-race to turn freely, also to clear the projecting end of the axle. This recess is $\frac{5}{8}$ in. diameter and $\frac{1}{16}$ in. deep, but there is no need to bother about "mike" measurements, as it is merely a clearance, and nothing fits in it. Cut it with the same tool. Note, pin-drilled recesses need this clearance also, and it is a simple matter to chuck the pin-drilled boxes in the four-jaw, and turn the clearance. More experienced readers could make a two-step pin-drill that would cut the clearance as well as the recess; and for their benefit, a sketch is appended, showing the cutting edges of a suitable drill. I use these stepped pin-drills for making pop safety-valve seatings, and other similar recesses.

The final job on the axleboxes is to tap the remnants of the 7/32-in. holes with $\frac{1}{4}$ in. $\times$ 40 tap, and make plugs to suit, from $\frac{5}{16}$ in. hexagon rod. An illustration of a plug is given, and our beginner friends should be able to do that job easily, with their acquired experience, without any detailing.



Wheel and axle

Wheels and Axles

The wheels are solid disc pattern, $2\frac{1}{4}$ in. diameter on tread, and are turned in exactly the same way as the *Tich* engine wheels. Chuck by tread, face back, centre, drill and ream. Use 27/64-in. drill, and $\frac{7}{16}$-in. reamer. Reverse in chuck, turn faces and bosses. Mount on an improvised faceplate, with $\frac{7}{16}$ in. centring peg, to turn the treads and finish flanges, all operations having been described in full detail for the engine. The axles are turned from $\frac{1}{2}$ in. round mild-steel, held in three-jaw, if the centre hole in the lathe mandrel will admit $\frac{1}{2}$ in. rod; if not, turn between centres, as previously described for *Tich*. Note—the $\frac{3}{8}$ in. ends are to be turned an easy push fit in the bore of the ball-bearings. One $\frac{7}{16}$ in. wheel seat is turned a press fit for the wheel, and the wheel is pressed on right away, as soon as the axle is finished. The other wheel seat is turned so that the wheel just slides on without any shake; this wheel slips on the axle when going around curves, thus saving rail and flange wear, as already explained. It makes the car very run easy. It has been suggested that the carrying wheels of a locomotive might be similarly fitted, but this would involve complications when the wheels are outside the frame; and anyway, the game isn't worth the candle, as there is a vast difference between the weight on the locomotive wheel, and the weight on the car wheels when same is carrying an adult passenger. The former can easily slip without the latter's grinding and tearing propensities.

How to Erect

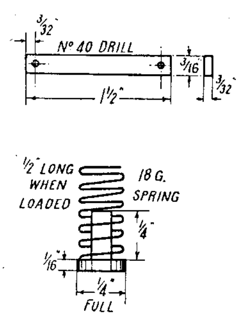
Eight springs, of 18-gauge steel wire, $\frac{1}{4}$ in. outside diameter, are needed. Our approved advertisers will probably be able to supply these ready-made, with the ends ground off square and to length. When an adult is on the car, the compression should be just sufficient to maintain the axleboxes midway between top and bottom of the horn slots. To prevent the springs bearing directly on the tops of the axleboxes, turn up eight pads from $\frac{5}{16}$-in. round steel, to the shape of flat-headed rivets, and to sizes shown. The stems should be an easy push fit in the springs.

The hornstays are $1\frac{1}{2}$ in. lengths of $\frac{3}{16}$ in. $\times$ 3/32 in. mild-steel strip, with a No. 40 hold drilled 3/32 in. from the end; they are attached to the side frames by 3/32 in. or 7-B.A. screws, round-head for preference.

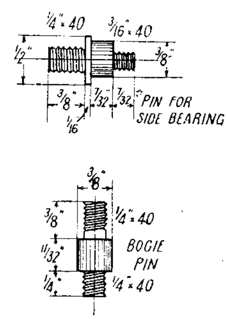
To erect, put the axleboxes, complete with ball-races, on the ends of the axles. Turn the bogie frame assembly upside down on the bench, drop the springs in the pockets, put the pads in, then fit the axleboxes to the horns, taking care that all the axleboxes are in their proper horns, the numbers matching. Put on the hornstays, and the bogie is complete. It should run very freely. If the loose wheels appear to have excessive sideplay, a brass washer between wheel and axlebox will cure it.

Bolsters

Castings may be available for the bolsters; but if not, they are easily bent up from $1\frac{1}{2}$ in. $\times$ $\frac{1}{8}$ in. soft mild-steel, a piece approximately $8\frac{1}{2}$ in. long being needed. The job is done in the bench vice, in the same manner as described for the similarly-shaped pump stand for *Tich*. Bend the channel part first, and the lugs afterwards. Drill a $\frac{1}{4}$ in. hole right in the middle of the bottom part, for the bogie pin. At $\frac{5}{16}$ in.



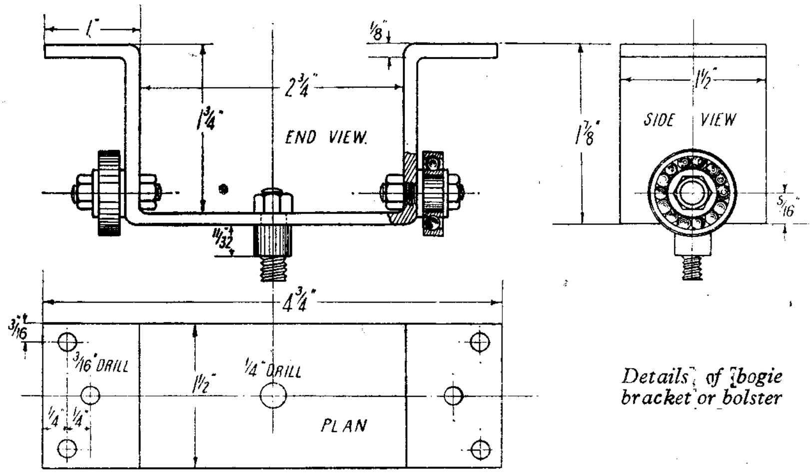
Hornstay and spring



Bearing and bogie pins

from the bottom, on the centre line of each side, drill another $\frac{1}{4}$ in. hole, for the pin carrying the swivelling bearings. The holes for the wood screws which attach the bolster to the seat board, are drilled $\frac{3}{16}$ in. at the positions shown.

The side bearing pins are made from $\frac{1}{2}$ in. round mild-steel, chucked in three-jaw. Turn down $\frac{7}{16}$ in. length to $\frac{3}{8}$ in. diameter, an easy push fit for the holes in ball races. Further reduce 7/32 in. length to $\frac{3}{16}$ in. diameter, and screw $\frac{3}{16}$ in.



Details of bogie bracket or bolster

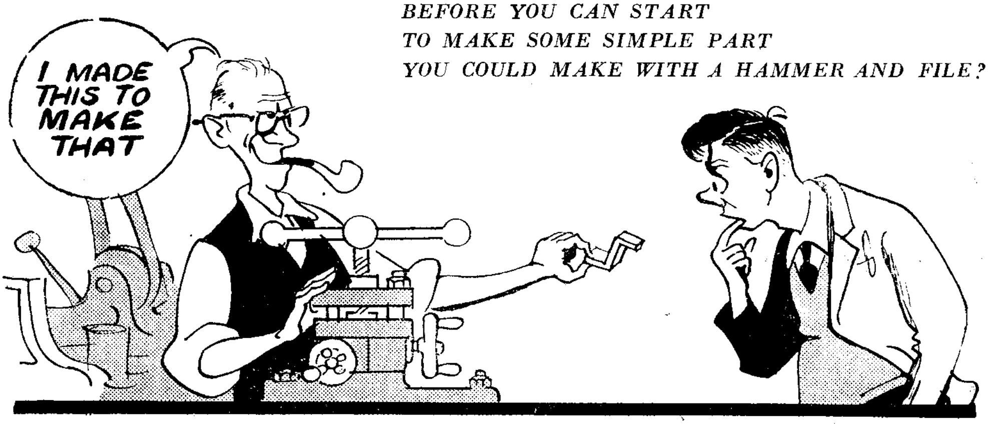
× 40. Part off at $\frac{7}{16}$ in. from the shoulder; reverse in chuck, holding by the $\frac{3}{8}$ in. part, turn down $\frac{3}{8}$ in. length to $\frac{1}{4}$ in. diameter, and screw $\frac{1}{4}$ in. × 40. Poke this end through the hole in side of bolster and secure with a nut. Chamfer the nut both ends, if it catches on the bottom of the bend. The nuts are made from $\frac{5}{16}$-in. hexagon rod, and need no detailing afresh. Put a ball-bearing on the $\frac{3}{8}$ in. part of the pin, and secure with a nut and washer. The outer race of the bearing should spin freely.

The bogie pin is turned from $\frac{3}{8}$ in. round steel. Chuck in three-jaw, face the end, and turn down $\frac{3}{8}$ in. length to $\frac{1}{4}$ in. diameter; screw $\frac{1}{4}$ in. × 40. Part off at a bare $\frac{5}{8}$ in. from the shoulder; reverse in chuck, and turn down a full $\frac{1}{4}$ in. length to $\frac{1}{4}$ in. diameter, leaving 11/32 in. length the full $\frac{3}{8}$ in. diameter. Screw $\frac{1}{4}$ in. × 40. Put the long end through the hole in the bottom of bolster, and secure with a nut. Put the bolster on the bogie, with the pin through the hole in the bush in the bogie centre, and secure with a nut and washer underneath. The ball-bearings will then run on the bogie centre-piece, and the bogie will turn on its pin, practically frictionless even when fully loaded.

Whimsical Workshop Warnings

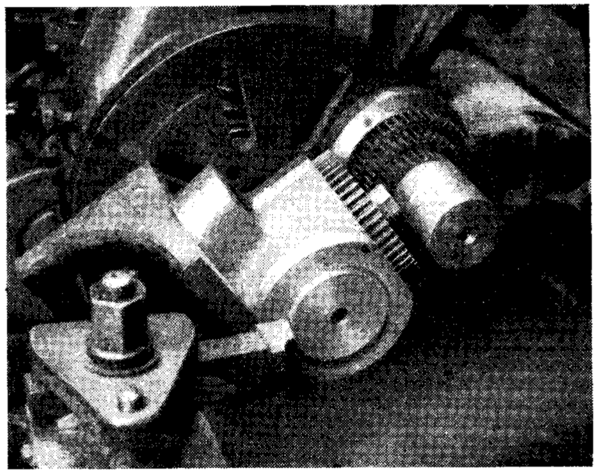
by Rick Elmes

I ASK YOU—NOW, IS IT WORTH WHILE
TO MAKE FIXTURES AND JIGS BY THE MILE,
BEFORE YOU CAN START
TO MAKE SOME SIMPLE PART
YOU COULD MAKE WITH A HAMMER AND FILE?



*A Universal Dividing Head, PLUS

by A. R. Turpin



Photograph No. 15. Turning the locating boss on the carriage

WHEN the mounted carriage is set, bore out to $\frac{11}{16}$ in. diameter to take the feedscrew nut, and at the same time cut a shallow groove along the body of the carriage to give a clearance to the feedscrew; this groove can be clearly seen in photograph No. 15. This photograph also shows the method of mounting the casting on an angle-plate on the faceplate for turning the locating boss. The flats seen in this photograph have been eliminated in the drawings, so do not imagine you have made an error. At the same time, the central hole may be drilled and tapped, using a " U " size drill, and tapping $\frac{7}{16}$-in. B.S.F.

The remainder of the work on the carriage should be left for the time being and a start made on the feedscrew and nut.

The Feedscrew and Nut

The former is of mild-steel cut 10 t.p.i. sq. thread $\frac{1}{2}$-in. diameter, see Fig. 12. When screwcutting long and slender material, such as this, it is necessary to use a travelling steady, but the jaws of the usual steady are too narrow and soft. If you possess a back toolpost a more efficient one for the job in hand can quickly be made as shown in Fig. 13.

A length of 1-in. sq. B.M.S. is cut $2\frac{1}{2}$ in. long, and a $\frac{3}{8}$-in. hole is drilled through it $\frac{3}{4}$ in. from one end. The tool holder is removed from the back toolpost, and replaced by this bar, and the ball handle clamping lever tightened up with the bar at right-angles to the lathe bed. Using the head stock drill chuck centre drill, and then drill and reamer to $\frac{3}{8}$-in. diameter a hole right through the bar.

Remove the bar from the toolpost, and mount in the four-jaw; push a stub of $\frac{3}{8}$-in. B.M.S. into the reamered hole and set this to run dead true; now bore out the hole to a thou. under $\frac{1}{2}$-in. diameter. Lap to the full $\frac{1}{2}$ in. Cut the bar across the hole as shown in the drawing, and then case-harden and polish. Remount bar on toolpost, and you have your steady.

Cut an 8 in. length of $\frac{5}{8}$ in. diameter mild-steel rod; face, and centre drill the ends, and mount between centres. Turn down to $\frac{1}{2}$-in. diameter for 7 in. using the steady for the final cut which should be positioned slightly behind the tool point, and then cut two grooves wih a parting tool $\frac{3}{16}$ in. wide, one $1\frac{1}{8}$-in. from the tailstock end, and the second $5\frac{3}{8}$-in. nearer the headstock, these are the start and finishing of the thread, they should be 0.055 in. deep.

The cutting tool tip's shape is shown in Fig. 13, the tool should be honed on all faces, and suds used as a lubricant when cutting the screw. It is obvious that if the travelling steady is fixed to the cross-slide it will be impossible to feed the tool in by this means, so some other way must be found.

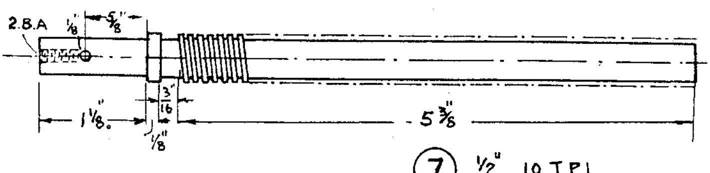
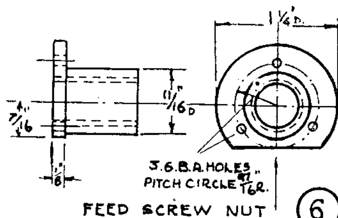


Fig. 12. Feed screw and nut



*Continued from page 705, " M.E.," November 29, 1951.

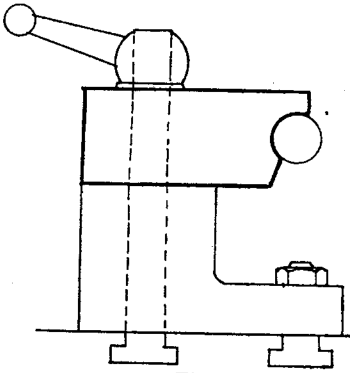
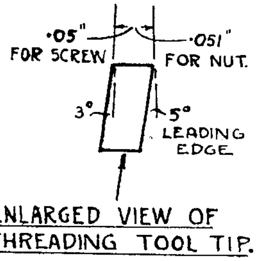
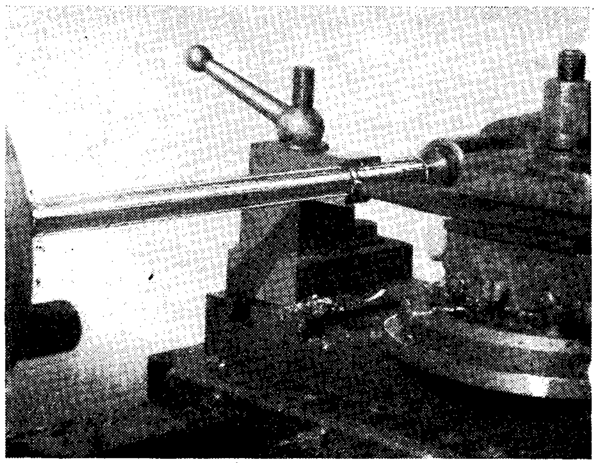


Fig. 13. *The travelling steady*



One of these is to mount the top-slide on a plate so that it may be turned through 90 deg.—see articles in THE MODEL ENGINEER, November 10th, 1949 and December 15th, 1949—or make up the special tool holder with self-feed—THE MODEL ENGINEER, July 8th, 1948 — the set-up showing the former method is shown in photograph No. 16. Next, set the gear train to cut 10 t.p.i.

With the tool just touching the work, and using slowest backgear speed, make a trial traverse and if O.K. take a note of the reading on the cross-slide index; feed the tool in 5 thous. and start cutting the thread; after a few cuts, and with everything going fine, you will be able to step up the speed to the next pulley. Continue feeding in the tool until you have added 0.05 in. to the index. The final feeds should be small, only a thou. or two, and finish by traversing at least twice without adding feed.



Photograph No. 16. *Set-up for cutting the feed screw*

Now turn down the tailstock end to $\frac{3}{8}$-in. diameter for a length of $1\frac{1}{4}$ in., put in the "D" centre and turn $\frac{1}{8}$ in. off the end to remove most of the countersink, and then cut off to length.

Chuck, drill, and tap the 2 B.A. hole in the end. Case-harden a $\frac{3}{8}$-in. steel washer, and hone both sides; place the washer over the end of the feedscrew, and pass that end through the hole in the lug on the top-plate, measure and mark a point on the feedscrew $\frac{1}{8}$ in. above the top surface of the top plate, and drill a $\frac{1}{8}$ in. hole transversely through at this point for the key pin.

Chuck a 2 in. length of bronze, say, $1\frac{1}{8}$-in. diameter, and drill and bore a central hole to a depth of 1 in. and $\frac{5}{8}$ in. diameter.

Reverse and chuck with $1\frac{1}{8}$ in. projecting, and drill and bore to exactly $\frac{1}{2}$ in. diameter, then proceed to cut your internal thread to a depth of 0.055 in. Note that the tool tip is 0.001 in. wider than the feedscrew tool. Make a trial entry of the screw and, if too tight, advance the top-slide half a thou.; the top-slide being now in its normal position parallel to the bed of the lathe, but before making this cut be certain that

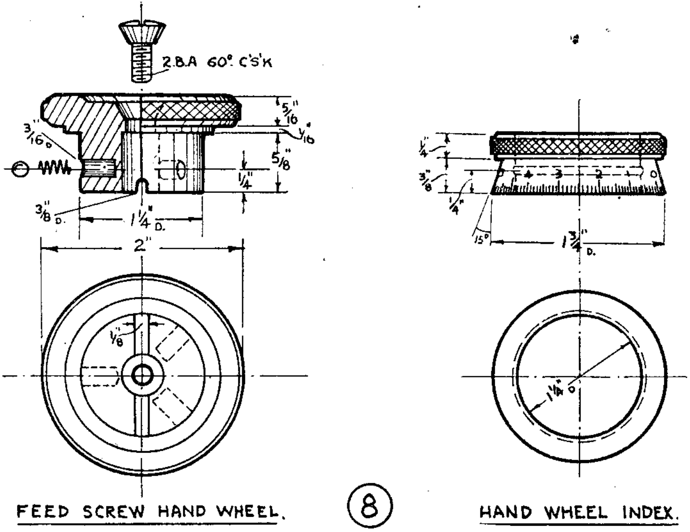


Fig. 14. *Hand wheel and index*

the stiffness is not caused by dirt or swarf.

The thread finished, turn down the outside as shown in the drawing to a push fit in the carriage, and part off to length.

Mark the position of the three 6 B.A. clearance holes, file the flat on the flange, push the nut into the hole in the carriage lug, and then drill the tapping holes through the nut flange and into the carriage lug using a No. 44 drill.

Remove the nut, and tap the hole, enlarge the holes in the nut flange to clearance size, No. 33. Screw nut to carriage.

The Handwheel and Index (8)

This consists of a handwheel proper, and a micrometer index using the principle suggested by Mr. A. G. Stenning, THE MODEL ENGINEER October 21st, 1948, and is shown in Fig. 14.

The boss on the handwheel is drilled $\frac{3}{8}$ in. and fits on the end of the feedscrew shaft, a $\frac{1}{8}$-in. groove filed or milled across the end of this boss fits over the pin in the shaft to ensure positive rotation, and the micrometer ring prevents the pin falling out. A specially made 60 deg. countersunk 2 B.A. screw holds the handwheel on to the end of the shaft, and allows adjustment for end play; because the bottom of the boss on the handwheel takes the end thrust, it should be given a high finish. Three $\frac{3}{16}$ in. diameter holes are drilled radially round the boss in the position shown in the drawings, and in these are housed a spring and a $\frac{3}{16}$-in. diameter steel ball; the springs may be those from an electric light socket, but they should be reasonably strong. The thimble is pressed home over the top of these balls, which spring into a groove cut in the inside of the thimble, and prevent it slipping off, and at the same time give it frictional control.

The handwheel may be turned from a bar of mild-steel chucked in the three-jaw, the $\frac{3}{8}$-in. hole should be bored to a nice fit on the feedscrew end, the 2 B.A. clearance hole and the boss being turned at one setting; it is then reversed in the four-jaw, adjusted to run true, and the countersink cut with a centre drill.

Recess the end of the wheel, knurl the periphery, and then radius the corners slightly below the knurling. By the way, when turning the boss, it is as well to scribe a line round it showing the position of the three $\frac{3}{16}$ in. holes, which can now be spaced out, and drilled as deeply as possible without breaking through into the centre hole.

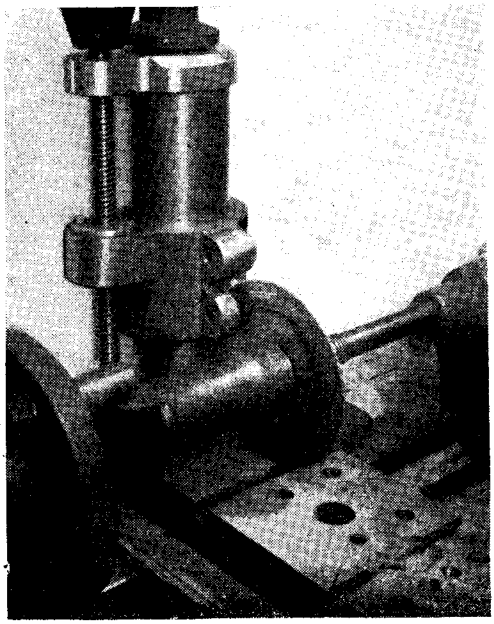
Although a description of the construction of the thimble will be given now, it is better to wait until the dividing head proper has been completed so that the dividing may be carried out at the same time as it is turned. Chuck a short length of $\frac{7}{8}$-in. mild-steel bar in the three-jaw, face, drill and bore to give a sliding fit on the handwheel boss. Round the tip of a boring tool to a radius of 3/32 in. and turn the groove in which the steel balls will run; the depth of this groove need only be 1/32 in. and if anything, should be slightly off centre towards the bottom of the thimble so that the balls tend to lift the thimble up towards the handwheel, thus giving better frictional control.

Set the top-slide over, and turn the 15 deg. taper, then knurl and shoulder.

Fit the dividing head at the rear of the mandrel and set to divide for 100 divisions. Place a " V " tool sideways in the toolpost and at exactly centre height. With the top-slide still at the 15 deg. position, feed in the tool with the cross-slide to a depth of 4 thous. and make a cut; the length of the cuts should be 0.1 for units, 0.15 for 5, and 0.2 in. for 10 thous. of 1 in.

Now knurl, shoulder, and then part off.

Place on a mandrel and stamp the figures 0 to 9. This completed, mount in the lathe once more on the stub mandrel, and with an oilstone slip remove the burr from the figures and dividing; this part is well worth while, as it gives the apparent rough figures a professionally engraved look. The thimble may now be assembled as previously described and you may want a helping hand to do it. Note that the thimble should be



Photograph No. 17. Slitting the carriage

about 0.01 in. shorter than the boss on the handwheel so that there is no chance of it rubbing on the surface of the top plate.

The pillar and carriage complete with feedscrew, but without the bottom plate, should be assembled and bolted to the cross-slide; the bottom plate being omitted so that the carriage may be moved that much lower on the pillar, the reason for this will be seen later.

Place a centre drill in the headstock drill chuck, and by operating the cross-slide and carriage feedscrew, bring one of the carriage lugs for the calmping-screws opposite, and proceed to centre drill it; the correct position having been previously marked out.

Now replace the centre drill with an " F " size drill, and push this right through. Open this hole to half depth with a size " O " drill. Raise or lower the carriage as the case may be, and drill the second lug in the same way. The holes may

now be tapped $\frac{5}{16}$-in. B.S.F. or this may be done later with the carriage removed.

Remove drill chuck, and mount a 4-in. diameter × 1/32 in. metal slitting saw between centres. Raise the carriage to the highest position on the pillar, and move the cross-slide until the pillar almost, but not quite, touches it. Bring the carriage centrally in line with the saw and start the latter revolving at top back gear speed, and then slowly feed the carriage down on to the saw so that it cuts it right through from bottom to top as shown in photograph No. 17. Even with the bottom plate removed, it may be found impossible to cut completely through the carriage at the top of it, but it can be finished off with a hacksaw when removed from the pillar, including the thin flake of metal left the whole way up.

(To be continued)

ADVICE TO YOUNG TED

Sage Comments by the Oldest Club Member

"GEORGE," said the secretary, as he entered the club hut, "Young Ted asked me if you'd drop in on the way home. He was very mysterious about it—hinted that a pint would be waiting your attention and impressed on me to be sure and ask you to call."

"Who am I to keep a perfectly good pint waiting?" said the Oldest Member with a smile, "I was just going anyway."

Ted was waiting at the gate and soon had the Oldest Member installed in an armchair with a glass of his favourite beverage at his elbow.

"Well," said George, filling his pipe, "You didn't ask me here because you thought I felt thirsty—what do you want to borrow? If it's my set of taps and dies—no, I'm using them!"

"No, it's not that," replied Ted with a worried glance, "The fact is, I was having one in the local yesterday with one or two of the chaps, including Charlie who's doing the syllabus this year. I don't know whether it was a put-up job but one thing led to another and before I came out I had promised to give a lecture next season, and I don't know how to start."

"Now, young fellow-me-lad," said the Oldest Member, "if you think I'm going to write a lecture for you—you're wrong, but I don't mind giving you a few tips which I find from experience will work.

"The first thing is—have you been given a specific subject? No? Well, that's a disadvantage; you must choose one for yourself and my advice is to select one on which you are really keen for its own sake—you will certainly be more fluent on something you like. In your case I would tackle a broad aspect of modelling, not a specialised, limited subject (a) because you are probably not experienced enough in modelling to know enough about one single aspect of the work and (b) your object is to interest as many of the audience as possible, and it is unlikely that you will pick on a very restricted line which they all want to know about in detail. The next requirement is a whole lot of facts. There is no better way of getting data on a subject than a visit to the local county library or by application to the Affiliation for the loan of books or to the technical press for advice on book titles or all of them. All these organisations exist for this purpose, and if you explain your requirement to them you will have all the information you need.

"I think you will be wise to be quite frank with your audience and tell them that you are not an expert in the subject and that you carried out this research in order to be able to talk on it. There is no disgrace in that, and they would soon find out, anyway! Usually—although this is dependent on the subject to some extent—some tracing of its back history is advisable; it is interesting and provides a sound background for your main theme. This is the next item to be stated and some care is desirable here to make sure that this is emphasised and made quite clear, with examples which support your statement.

The next natural phase of your case will be the exceptions—those which are apparent exceptions to the general statement which you have made, and those which are real exceptions and require qualification. The final heading is the conclusions to be drawn from the data which you have given and—if the remarks are in place—some reasoned predictions on the future likely developments which may be deduced from the conclusions.

"That is the very general pattern which I suggest—jot down the headings in order if you like—first, get as much data on the subject as possible; study it and select the relevant facts. Assemble these in a logical order to establish the basis of your case. State the main theme with examples, comment on the possible exceptions and then give your conclusions, finishing on the note 'that's what I know about the subject—any further contributions from the audience will be gratefully received.'

"I would emphasise that the success or otherwise of the talk is dependent largely on the amount of research and preparation made beforehand, so be prepared to settle down to some hard reading, and if this is your first public appearance I should write it all down so that if you attempt to talk extempore you can always get back to the point.

"There you are, my lad—it's up to you. If I did any more for you I would be doing you a disservice; the best of luck—I'll be there to hear you!"—G.G.C.

IN THE WORKSHOP

by "Duplex"

No. 104.—*Making a Twist Drill Grinding Jig

THE next component to be made is the small tailstock (Q) for feeding the drill up to the grinding wheel.

As will be seen in the illustrations, the body of the tailstock is made in two parts secured together with two 6-B.A. cheese-head screws. The part carrying the V guide is made from the portion of shaped material left over after the drill rest has been cut off, and the part in which the feed-screw is mounted is best cut out of a short length of $\frac{3}{4}$ in. square mild-steel.

When the two parts have been shaped to fit together, they can be clamped in this position by means of a 2-B.A. screw inserted in the hole that serves to carry the finished clamp-screw; this enables the hole for the feed-screw to be marked-out from the apex of the V channel and at a height of 7/32 in. to give clearance for the feed-screw itself. It is, of course, important to drill and tap this hole in true alignment with the V; otherwise the loose head of the feed-screw will not move freely when adjusting the position of the drill in relation to the grinding wheel. The clamp-screw is fitted with a loose revolving head, made of duralumin so as not to damage the under side of the drill slide, and the length of the head is adjusted to bring the clamp handle into a convenient working position. If necessary, the sides of the feather formed on the tailstock must be carefully hand-scraped to allow the tailstock itself to slide freely in the long keyway.

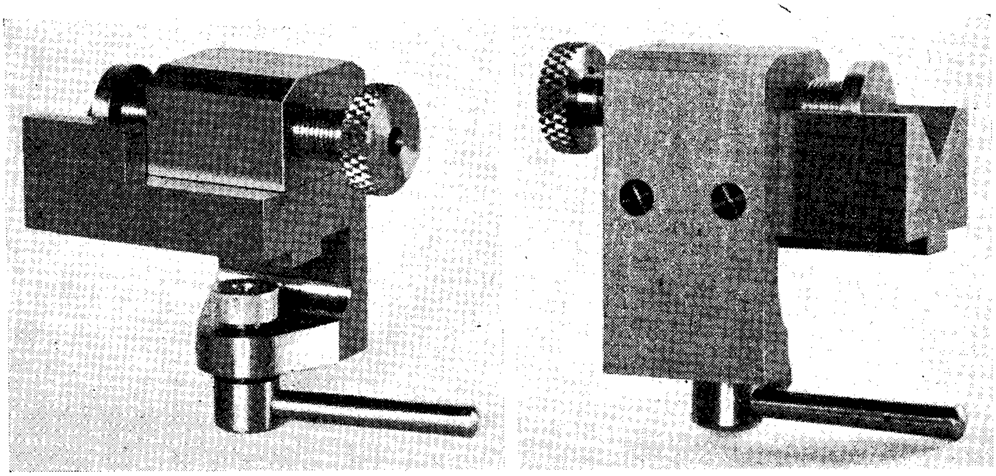


Fig. 29. Two views of the tailstock

The loose head of the feed-screw is turned from a length of $\frac{7}{16}$ in. dia. mild-steel rod and, after the end has been filed to a heart shape to fit accurately in the V, the part should be case-hardened to resist wear. The small spring grips the tail of the loose head, and the loop formed at the other end of the spring is made a tight fit in the $\frac{1}{8}$ in. dia. axial hole drilled right through the feed-screw. To assemble the loose head, the feed-screw is first screwed into place and a length of thread is attached to the spring loop and then passed through the axial hole; when the spring has been drawn into place by pulling on the thread, it will be found that the spring tension always keeps the loose head pressed against the end of the feed-screw. Although this may seem a trivial addition and, perhaps, hardly worth the trouble of fitting, it will, nevertheless, avoid the possible irritation caused by the loose head being left behind, and having to be pushed into place, whenever the feed-screw is turned back.

The next operation is to cut away the table, as shown in Fig. 23, to allow the tailstock to slide forward and meet the drill rest.

The Drill Slide Clamp-screw—O

This is a straightforward piece of work, but it should be noted that the nut, which fits into a recess formed on the underside of the table, is provided with a screwdriver slot to enable the parts to be assembled. As the clamp handle is too long for the screw to turn fully, the clamp-screw is first inserted and the nut is then screwed down until the clamp handle, when tightened, comes

*Continued from page 726, "M.E.," November 29, 1951.

into a convenient position; the nut is next secured against turning by means of an Allen grub-screw, fitted to the right-hand side of the table, as shown in Fig. 24. This method of fitting enables an exact adjustment to be readily made without having to use packing washers.

The Lip Gauge—R

When a twist drill is placed in the Vs of the drill rest and the tailstock, the purpose of the lip gauge or guide is to align the lower cutting edge of the drill exactly vertical as illustrated in Fig. 11; this is important to enable the correct back-off to be obtained. Moreover, the lip gauge must act as a guide for drills of any diameter within the capacity of the jig.

This part is made of either carbon-steel or mild-steel, approximately 40 thousandths of an inch in thickness, and must be finally hardened to resist wear. Forming the gauge is done by carefully filing, both to fit the part into the recess formed in the end of the drill rest and to shape the guide edge accurately. The guiding edge must be thinned on the inner side to an acute angle to allow the smaller drills to be aligned correctly whilst making even contact with the floor of the V cut in the drill rest. Owing to the thinness of the material and the smallness of the part, the lip gauge is attached by means of a single, countersunk-head, 6-B.A. screw, but the recess in the drill rest will give adequate location.

The shaping of the guide edge of this form of lip gauge to align the smallest drills, having a standard angle of twist, hardly seems possible. For if the lip of, say, a No. 60 drill is held against a piece of thin shim material and allowed to project for 10 thousandths of an inch, it will then be found that the cutting edge does not lie parallel with the edge of the guide-piece owing to interference by the sloping land of the drill. Moreover, if an attempt is made to shape the gauge fitted to the jig to hold the cutting edge of the drill truly vertical, it will then be found that the drill tends to ride up in the V of the drill rest. To overcome these difficulties, it was decided to use a special holder to carry drills of size 50 and under, but if there is any difficulty in getting slightly larger drills to line up correctly, the same holder will still serve if drilled accordingly.

When the holder is used, the lower part of the guide face of the lip gauge can be filed to give clearance for the points of small drills. This holder is shown in Fig. 34, carrying a No. 50 drill ready for grinding, and in Fig. 35 the holder will be seen keeping this drill correctly aligned in the jig.

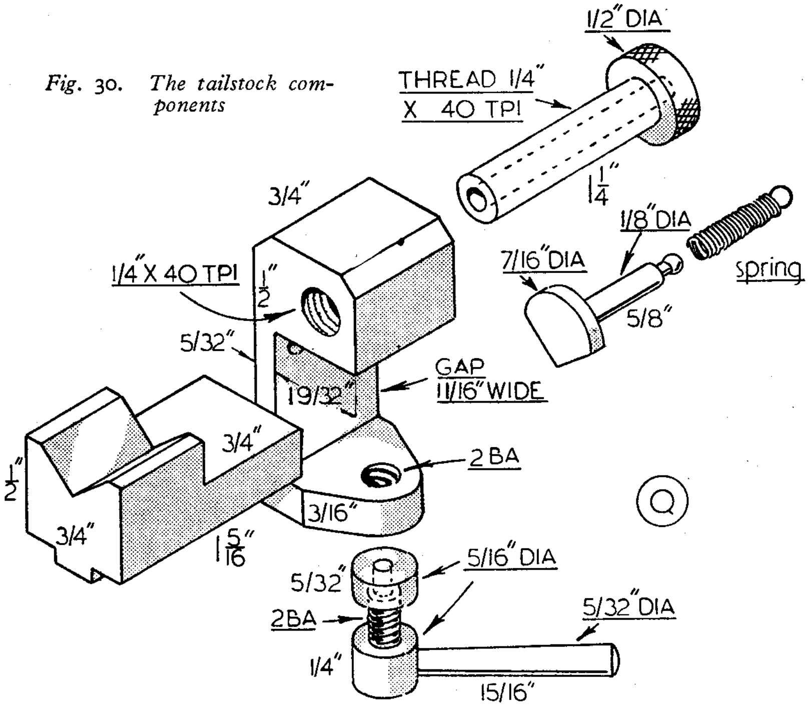


Fig. 30. The tailstock components

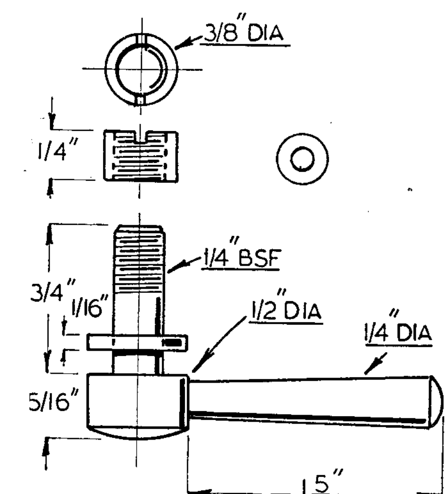


Fig. 31. The drill slide clamp-screw and nut

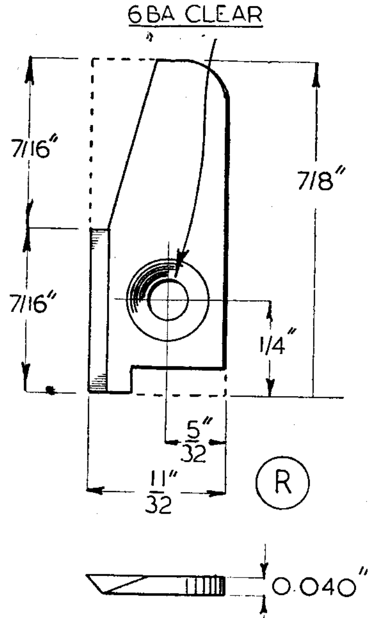


Fig. 32. The lip gauge

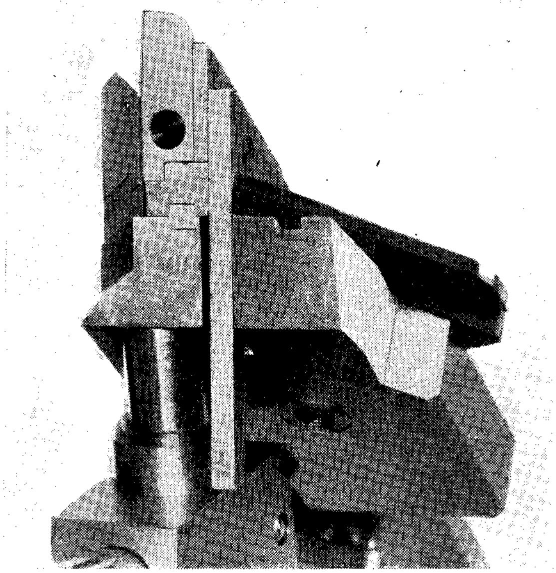


Fig. 33. Showing the position and method of fixing the lip gauge

A piece of $\frac{1}{4}$ in. square material is used to make the holder, and this is drilled at its centre with a No. 50 drill. The drill being ground is held in place, with the cutting edges lying vertically, by means of a 10-B.A. cheese-headed screw fitted flush with the end of the holder. In use, the ends of the drill, as before, lie in the two V blocks, and the lower limb of the holder slides in the long keyway cut in the drill slide but without bottoming. The holder is filed to a good sliding fit in this keyway, so that when it is turned through 180 deg. the other lip of the drill is also correctly aligned. In addition, the upstanding limb of the holder gives a convenient finger-hold for steadying the drill during grinding. To test the device, a small batch of No. 60 drills was ground and the results were in every way satisfactory, for the drills cut freely with but little applied pressure and, in addition, the drills were found to be a good fit in the holes formed.

It should, however, be pointed out that, when the holder is used, the cutting edges of small drills will not remain vertical if the point of the drill is ground away appreciably ; whereas, with

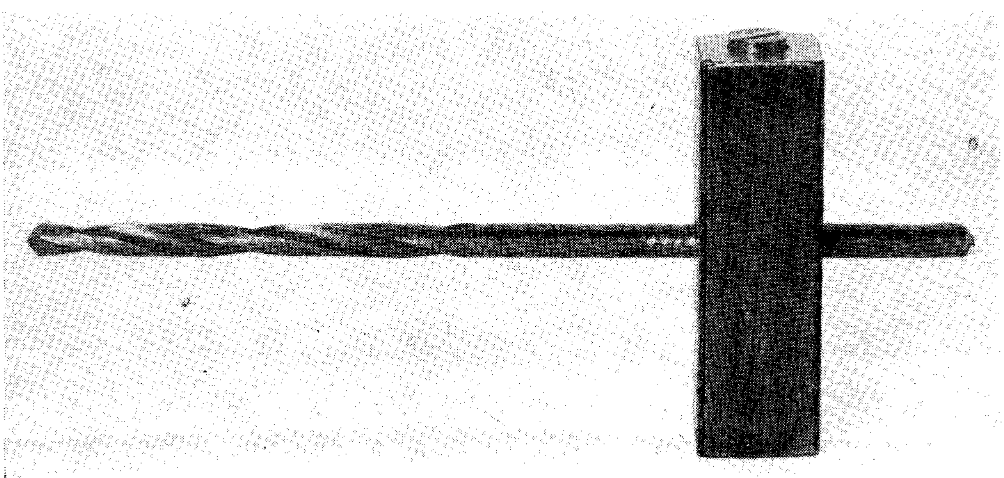


Fig. 34. The special holder carrying a No. 50 drill

a lip guide, the edges of larger drills are automatically always held vertically where the guide is correctly shaped.

If, therefore, much material has to be removed from the point of a small drill, it is advisable to set the drill in the holder with the upper cutting edge turned a little to the right of the vertical line. In this way, the necessary correction will be made automatically as the point of the drill is ground away.

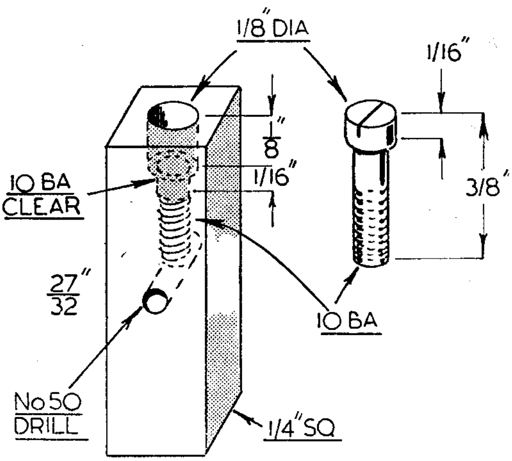


Fig. 36. *The holder for small drills*

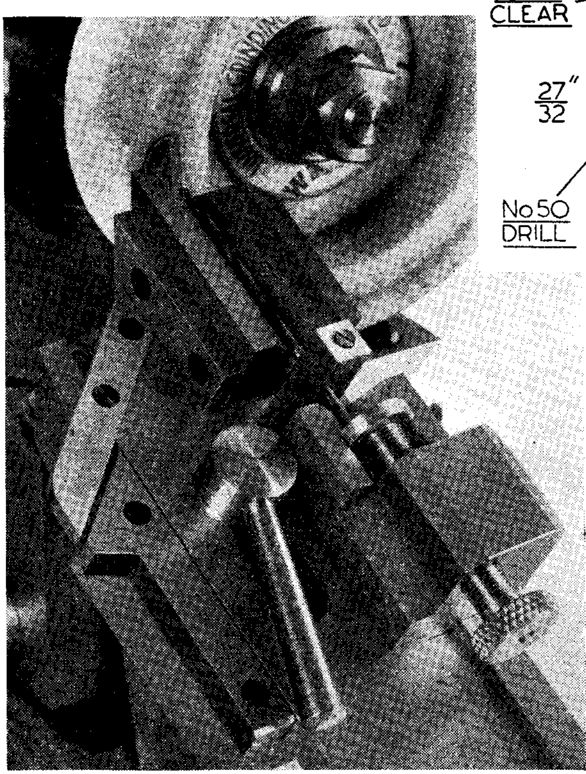


Fig. 35. *The drill holder seen in position in the jig*

By thus altering the position of the drill in the holder, the amount of back-off can be varied at will, and after a little practice drills can be set to give the particular form of point required for drilling various materials.

An increase of the back-off may be found an advantage in the smallest drills, for this seems to give free cutting with a minimum of drilling pressure and, at the same time, the torsion on the drills is lessened and the liability to breakage thus reduced.

In a subsequent article we hope to be able to comment on alternative methods, suggested by past and present correspondents, of aligning small drills so as to meet the shortcomings of the ordinary form of fixed lip gauge.

(*To be continued*)

For the Bookshelf

The Electric Current, by P. Dunsheath, C.B.E., M.A., D.Sc., F.Inst.P. G. Bell & Sons Ltd. Price 18s. 6d. net.

Here is a very readable book, based on a recent series of the famous lectures given each Christmas at the Royal Institution—The Christmas Lectures.

Electricity tends to remain an unsolved mystery to large numbers of the non-technical community, and Mr. Dunsheath obviously had this in mind when he compiled his book. Starting with a brief review of historical development, the reader progresses gradually from the ancient study of amber, through Galvani's twitching frog's legs, to the giant 33,000 volt generators of today.

This is not a technical book in the accepted sense, and for this reason it can profitably be read and assimilated by the layman. Indeed, with electricity becoming more and more popular as an aid to living in this modern age, it *should* be read by every householder and his sons and daughters. And we must not forget the housewife. When she has digested the early chapters, the closing chapter, "The Current in the Home," will help her to solve the mystery of the Hoover, the 'fridge, the electric iron and the many other gadgets which have become the servants of her daily routine.

The book is well produced and illustrated with many line drawings and half-tone plates.

PRACTICAL LETTERS

Further Work on "Triton II"

DEAR SIR,—With further reference to my hydroplane *Triton II*, which was described in THE MODEL ENGINEER dated August 24th, 1950, I have been making a number of modifications, including the fitting of an inclined valve-head. I also decided to try out glow-plug ignition and, after several experiments with different plug positions and different sizes of choke tubes for the carburettor, I managed to get the engine running successfully. In these experiments I have had the help of Mr. Bamford, a very keen fellow member of the Aldershot & District Model Engineering Society. Having obtained permission to run our boats on Fleet pond, we went there on Sunday mornings, week after week, and my boat has made several successful runs at 40 m.p.h. on glow-plug ignition. I can obtain full control on the throttle from about 1,000 r.p.m. to 10,000 r.p.m. and the power output is very good ; also, the boat will get away at full bore without any assistance by pushing off. It appears that the position of the glow-plug is very critical, but once obtained, the performance is as good as I was getting under spark ignition, while the weight reduction is a great asset. The boat is rather on the heavy side, weighing 8 lb. 13 oz. but I am making a new hull this winter, which I hope will be lighter and attain higher speed. The engine is of 15 c.c. capacity with inclined valves operated by overhead camshaft. It is fitted with a slightly modified Atom type R carburettor. Mr. Bamford and myself invite any model power boat enthusiasts to get in contact with us with a view to arranging a meeting at Fleet pond. The water is extremely suitable for fast boats, the depth only about 3 ft. and no back-wash from banks. Will anyone interested, please write to me at the address below.

Mr. Reynolds starting "Triton II"

2, Ley Road,
Hawley Estate,
Farnborough, Hants.

Yours faithfully,
G. D. REYNOLDS.

An Interesting Old Model Steam Engine

DEAR SIR,—I wish to convey my sincere thanks to the correspondents who so kindly replied to the request for any information available on the old-time steam engine which was the subject of an article published in the June 21st issue of THE MODEL ENGINEER.

Mr. Welham in his letter (September 6th, page 337) mentions seeing such a model in Ipswich. This bears out the statement of the dealer from whom I purchased the engine, who said he thought it came from a sale near Colchester.

Mr. Stocks writes (November 1st, page 596) of seeing a prototype engine of similar layout at the Leeds Fireclay Co. He has certainly roused my curiosity, and I do hope he will be able to see the engine re-erected in his home town. It would be most interesting to find the model was that of the second oldest horizontal engine thus to be preserved.

Mr. Nicholls has provided quite a feast of detail in his article (November 8th, page 621), and I agree the model does suggest the practice of Easton and Amos in construction of rods and governor. The latter in particular is well represented in the fine engine model illustrated on the cover of the October 12th issue of THE MODEL ENGINEER 1950. The model there

shown is Mr. Hawker's E. & A. grasshopper beam engine which won a bronze medal at the 1950 show. As far as I can see, the governor is exactly the same in all details. I still say, though, that *my* model's governor is really tremendous in size!

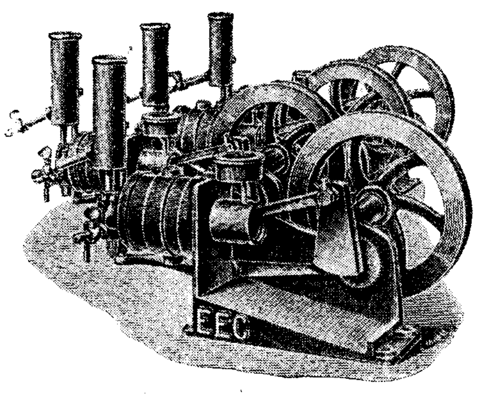
Mr. Nicholls rightly corrects "cast-steel" to "cast-iron" for the slide bars. Actually, I had been thinking in terms of "steel," for this is what the model builder used for his flat top bar, and I added a rib of unpolished steel to give the flat bar the cast "iron" touch of the prototype. Thank you, Mr. Nicholls.

I doubt whether the original engine would have been semi-portable. The flywheel is of mill-like proportions and the crankshaft with its three bearings would be of tremendous weight in full size. All the various parts are of extremely massive proportions, and, indeed, the model is of quite considerable weight. Mr. Stock's mention of the winding engine seems likely, though his flywheel has only four spokes against six in the model.

Yours faithfully,
Bromley, Kent. F. P. LEWIS.

"New Engines For Old"

DEAR SIR,—I was interested in the above article and have before me, as I write, the original illustrated advertisement of these engines, as published in THE MODEL ENGINEER during 1909.



The bore and stroke are given as $1\frac{3}{8}$ in. × 3 in., and the power as 45 watts. I hope the "M.E." workshop manages to work it up to this standard. The wedge-shape cast-iron crank arm is the same, but the exhaust valve lever is much neater. The price of a set of castings is given as 14s., and the finished engines at £3—hardly an exorbitant charge even for those far away days.

Yours faithfully,
Swanage. H. E. RENDALL.

Scraping

DEAR SIR,—I am grateful to A.E.U. for his article of November 8th. I have waited for such an article for a long while, or rather, I have waited for an article that would tell me in simple terms how to obtain those beautiful mottled surfaces, those ornamental surfaces scraped in geometric patterns. Unfortunately A.E.U. calls a halt, just as the reader's appetite is whetted and states flatly that the "way how" is best found by experiment and practice! Surely, some of your readers, skilled in the art of scraping, are capable of describing the mechanics of the process? For instance, why not plot the track of the moving scraper, indicating direction by arrows and pressure by thickness of line?

Yours faithfully,
Twickenham. A. F. BANYARD.

How to Make It

DEAR SIR,—With reference to Mr. J. D. Bisdee's letter on this subject. The section which appeals very strongly to me deals with "more general workshop and how-to-make-it articles."

This plea I can certainly endorse. I, too, can say I've never made a model in my life except, of course, at school. "Duplex" tells how to make a rear toolpost. Mr. Sparey gives similar advice among other useful small tools (but how to get the material for making is a great problem). In my view to be able to make a useful tool, or to adjust, recondition or sharpen any item in the home or workshop is my idea of usefulness. Most models seem to be bound for the "Sale" column after the initial flush of excitement is over.

Yours faithfuly,
Bourton-on-Water. ALF ROBERTS.

Musical Box Combs

DEAR SIR,—Possibly the following may be of interest to the writer of the letter appearing in THE MODEL ENGINEER dated 25/10/51. These articles are produced largely in Switzerland, and it is reasonable to suppose that as the trade is specialised, not a great deal of information leaks out about the methods used. However, it is known that the slots are ground in these combs by using an abrasive rubber bonded slitting-wheel which can be supplied by some grinding wheel manufacturers down to 0.003 in. thick. These wheels are, of course, extremely fragile, and this means that a different approach to their application is necessary than in the case of normal grinding wheel methods.

The biggest difference is the mounting of the wheels. Their thinness necessitates the use of large diameter side plates, which will leave only sufficient wheel exposed to clear the cut. This precludes the possibility of making a square-bottomed cut, where the depth is in excess of the amount of wheel protruding from the plates. However, as the combs themselves are thin, this point may not be considered detrimental.

Finally, it is not known whether musical box manufacturers use mass production methods, but it may be possible to gang these wheels together with steel spacers between them so that all, or a quantity of slots could be ground together. The different depths required would present a problem, but is not insurmountable, as different diameter wheels could be used to produce this condition.

The wheels can be obtained from Universal Grinding Wheel Co., Stafford.

Yours faithfully,
Stafford. L. J. PRESTON.